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PICKERING NGS B
POSTOPERATIONAL AQUATIC STUDY, 1988

Report No 89-149-K

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ABSTRACT

Results of the third year of the Pickering NGS B postoperational fish survey conducted in 1988 are presented and compared to results of the 1979-1981 preoperational studies and the 1986 and 1987 postoperational studies. The objective of the study is to describe and detect gross changes in the fish community of the study area and assess potential effects of the operation of the station on it during the 1986-1988 postoperational phase. Alewife was the most abundant fish taken in the beach seines, trap nets and gill nets. Lake trout and brown trout co-dominated the gill net catch in terms of biomass. Some species of recreational value, including lake trout, brown trout, coho salmon and round whitefish have increased in abundance since the preoperational years. Stomach analyses of salmonids captured in 1988 indicated that lake trout consumed mainly rainbow smelt while brown trout consumed similar portions of rainbow smelt and alewife. Results of a tagging program suggested that lake trout are long distance travelers and that they are unlikely to remain in the thermal plume for extended periods. Brown trout, in contrast, do not travel as extensively and may remain in the thermal plume for sufficiently long periods that their sexual maturation and in turn spawning success may be affected. Round whitefish was the most common fish present in the round whitefish spawning study area during the weeks of December 7 and 15. Occurrence of maximum catches of round whitefish suggested a mid-December peak spawning period. As in 1986 and 1987, the largest total number and largest single catch of round whitefish were taken at the Pickering NGS B discharge 7 m location.

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EXECUTIVE SUMMARY

PICKERING NGS B
POSTOPERATIONAL AQUATIC SURVEY, 1988

J.K. Kwik
Biological Research Section
Chemical Research Department

Results of the third year of the Pickering NGS B postoperational fish survey conducted in 1988 are presented and compared to results of the 1979-1981 preoperational studies and the 1986 and 1987 postoperational studies. The objectives of the fish survey are to describe the fish community of the study area in sufficient detail that gross changes may be detected and to assess the potential effects of the operation of the station on it during the 1986-1988 postoperational phase. The results of the 1979-1981 preoperational studies, 1982-1985 interim studies, and 1986-1988 postoperational studies will ultimately be compared in an effects report. These studies were requested by Environmental Studies and Assessments Department of the Design and Development Division - Generation of Ontario Hydro on behalf of the Pickering Engineering Department.

Beach seine catch indicated that the fish species composition of the shallow inshore areas of the Pickering NGS B study area has stayed relatively constant. Alewife was the most abundant species present in the beach seine catch in all preoperational and postoperational study years. As in most previous study years, 1988 beach seine catch was highest at Duffin Creek. The 1988 May-October average catches (catch-per-unit-effort=CUE) for the postoperational studies were lower than they were for the preoperational studies.

Trap nets sampled fish of the inshore area up to a depth of 3 m. Alewife was the most abundant species in the 1988 trap net catch as it had been in all previous study years except 1980, when brown bullhead were more abundant. The location at which the highest trap net catch was taken varied among years. In 1988, the largest trap net CUE was obtained at the Pickering NGS B discharge. Brown bullhead has consistently been taken in highest numbers

job	file	date	report no.
34-185-492	837.321PIC	July 7, 1989	89-149-K

at the Pickering NGS A discharge since 1979. Trap net CUE declined through the postoperational years but was still within the range obtained for the preoperational years.

Gill nets sampled fish along the bottom strata, between the 3 and 15 m depth contours. Alewife dominated the gill net catch numerically in all study years. However, lake trout, whose CUE had increased substantially since 1983, dominated the catch in terms of biomass in 1986 and 1987 and co-dominated with brown trout in 1988. The average catches of lake trout, brown trout and coho salmon were all substantially higher for the postoperational studies than for the preoperational studies. The increase in abundance of lake and brown trout were a result of steady stocking since the early seventies. Coho salmon have been stocked at a lower level than lake and brown trout since the late sixties.

Stomach analyses indicated that lake trout consumed mainly rainbow smelt, with lesser amounts of sculpin and alewife. Brown trout preyed equally on rainbow smelt and alewife, and to a lesser degree on gizzard shad. A larger proportion of stomachs had contents in the spring and early summer when rainbow smelt and alewife were more abundant in the study area. Gizzard shad were only found in stomachs of fish collected in December.

A tagging program was carried out during the postoperational years with the objective of determining whether salmonids remained in the thermal plume for long enough periods that their spawning success might be affected. The results suggest that lake trout are long distance travelers and that the chances of them remaining in the study area are small. Thus, it is unlikely that this species would remain in the thermal plume for long enough periods to have their sexual maturation, and in turn, spawning success affected. Brown trout do not travel as extensively as lake trout and there is a chance that some of them would remain in the thermal plume for sufficiently long periods that their sexual maturation and spawning success might be affected.

The concern with the round whitefish in the study area is that the Pickering thermal plume will decrease round whitefish populations through egg hatch advancement. Round whitefish was the most common fish species taken by gill nets set in the weeks of December 7 and 15, 1988. As in previous years, round whitefish were most abundant in mid-December, suggesting a mid-December peak spawning period. Largest total number as well as the largest single catch of round whitefish were taken at the Pickering NGS B discharge transect as they were in 1986 and 1987. This suggests that round whitefish may be spawning in areas influenced by the thermal plume, in which case, egg hatch advancement likely occurs in the spring.

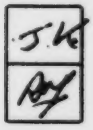

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Objectives	2
	1.2 Study Area	3
2.0	METHODS	3
	2.1 Juvenile and Adult Fish Survey	3
	2.2 Round Whitefish Spawning Study	6
3.0	RESULTS AND DISCUSSION	6
	3.1 Water Temperature	6
	3.2 Juvenile and Adult Fish Survey	6
	3.3 Round Whitefish Spawning Study	32
4.0	SUMMARY	39
5.0	ACKNOWLEDGEMENT	41
LITERATURE CITED		42
APPENDICES		
DISTRIBUTION		last page

LIST OF TABLES

Table		Page
1	Station Operating Conditions During 1988 Fishing Periods	5
2	Number and Per Cent Composition of Fish Caught by Beach Seines - Pickering NGS B 1988	9
3	Average Beach Seine Catch (Fish/Haul) Along Four Transects - Pickering NGS B	11
4	Comparison of Pickering NGS B Preoperational and Postoperational May to October Beach Seine Catches	12
5	Comparison of Beach Seine May and August CUE - 1979-1981, 1984-1985 and 1986-1989	13
6	Number and Per Cent Composition of Fish Caught by Trap Nets - Pickering NGS B	14
7	Average Trap Net Catch (Fish/Net) Along Four Transects - Pickering NGS B, 1987	16
8	Comparison of Pickering NGS B Preoperational and Postoperational May to October Trap Net Catches	18
9	Comparison of Trap Net May, August and November CUE - 1979-1981, 1984-1985 and 1986-1988	19
10	Number and Per Cent Composition of Fish Caught by Gill Nets - Pickering NGS B, 1988	21
11	Average Gill Net Catch (Fish/Net) at 3 and 12 M Depths Along Four Transects - Pickering NGS B, 1988	23
12	Comparison of Pickering NGS B Preoperational and Postoperational May-November Gill Net Catches	24
13	Comparison of Gill Net May, August and November CUE - 1979-1981, 1984-1985 and 1986-1988	28
14	Stomach Contents of Lake Trout, Brown Trout, Rainbow Trout and Coho Salmon Collected in March - December 1988	30
15	Stomach Content of Lake Trout and Brown Trout by Month - Pickering NGS B, 1988	31
16	Number of Fish Tagged and Number of Tag Returns in 1986-1988, Pickering NGS B Postoperational Study	33

LIST OF TABLES (Con't)

Table		Page
17	1986-1988 Lake Trout Tag Returns	34
18	1986-1988 Brown Trout, Rainbow Trout and Small Mouth Bass Tag Returns	35
19	Number of Fish Caught by Gill Nets During the Pickering NGS B Round Whitefish Spawning Study - 1988	36
20	Round Whitefish Study - Pickering NGS B 1988 Fish Catch by Location	38

LIST OF FIGURES

		Page
Figure 1	Pickering NGS B Postoperational Aquatic Study 1988 Sampling Locations	4
Figure 2	Mean Daily Temperatures at the 12 m Depth Offshore From the Pickering NGS B Discharge in 1988	7
Figure 3	Cue of Alewife, Rainbow Smelt and White Perch, 1979 - 1981 and 1986 - 1988.	26
Figure 4	Round Whitefish, Brown Trout, Lake Trout and Coho Salmon, 1979 - 1981 and 1986 - 1988.	27

LIST OF APPENDICES

Appendix		Page
I	Pickering Beach Seines 1988, May - October	A1-1
II	Pickering Trap Nets 1988, May - October	A2-1
III	Pickering Gill Nets - May 12 & 13, 1988 - June 7 & 8, 1988 - July 5, 6, & 7, 1988 - August 3 & 4, 1988 - September 7 & 8, 1988 - October 4 & 5, 1988 - November 2 & 3, 1988	A3-1
IV	Common and Scientific Names of Fish Species Collected 1987 Pickering NGS B Postoperational Study	A4-1
V	1988 Temperatures (C) at Pickering NGS B Beach Seine Locations	A5-1
VI	1988 Temperatures (C) at Pickering NGS B Trap Net Locations	A6-1
VII	1988 Surface and Bottom Temperature (C) at Gill Net Locations	A7-1
VIII	Maximum, Minimum and Average Temperatures Recorded by Continuous Monitors at the 3M Depth Contour Along Four Transects Fished	A8-1
IX	Round Whitefish Study - Pickering NGS B, 1988	A9-1
X	1988 Temperatures at Round Whitefish Spawning Study Gill Net Locations	A10-1

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To: Dr W.R. Effer
Manager
Environmental Studies and Assessment Department
Design and Development Division - Generation

PICKERING NGS B
POSTOPERATIONAL AQUATIC STUDY, 1988

1.0 INTRODUCTION

Pickering NGS B is a nuclear station consisting of four CANDU powered 540 MW units (Units 5-8) located on the north shore of Lake Ontario at Pickering, Ontario. All four units were in service by February, 1986; Unit 5 first produced electricity in December of 1982, Unit 6 in November of 1983, Unit 7 in November of 1984 and Unit 8 in January of 1986.

The station is situated on the east side of Pickering NGS A which also consists of four CANDU powered 540 MW units (Units 1-4). The stations have a common surface condenser cooling water intake. Pickering NGS B uses 33.4 m^3 of cooling water per unit per second and Pickering NGS A uses 30.8 m^3 per unit per second. Pickering NGS B discharges its cooling water to the east of the development while Pickering NGS A discharges to the west. The calculated temperature increase across the condenser with two pumps per unit and four units operating is estimated at 9.2 ^{o}C for Pickering NGS B and 9.7 ^{o}C for Pickering NGS A (RMEP-IR-07211-1).

Combined operational capacity in 1988 was either six or seven units for most of the year which was higher than it had been in previous years. Units 1, 5, 6 and 7 had occasional short outages. Unit 2 had been down since August 1, 1983 for pressure tube replacement but came back on line on October 31, 1988. Planned and maintenance outages took place from late-March to late-April for Unit 3, from mid-November to end-December for Unit 4 and from mid-May to early-July for unit 8.

A Pickering NGS B preoperational aquatic study was conducted between 1979 and 1981 (Ontario Hydro Research Division Report No 84-135-K). Interim studies were conducted during the 1982-1985 commissioning period (Ontario Hydro Research Division Report Nos 83-193-K, 83-135-K, 84-341-K and 87-149-K) and the postoperational studies were carried out from 1986 through 1988 (Ontario Hydro Research Division Report Nos 87-194-K and 88-261-K).

The results of the 1988 fish survey and round whitefish spawning investigations are presented in this report. The juvenile and adult fish surveys have been carried out annually since 1979 at a similar effort in the pre- and postoperational studies and at a reduced level during the interim studies. During the pre- and postoperational phases, these studies included monthly beach seining and trap netting from May through October, and monthly gill netting at two depths from May through November. Fishing was conducted along four transects between the Pickering NGS A discharge and Simcoe Point. During the interim studies, fishing was limited to May and August for beach seining and May, August and November for trap netting and gill netting. The results of salmonid stomach analyses as well as a tagging program carried out from 1986 to 1988 are also presented.

The round whitefish spawning study consisted of weekly gill netting, along six transects between Pickering NGS A and Thickson Point, in November and December. During the interim studies, in 1984 and 1985, only Whitby West and Thickson Point were fished for spawning round whitefish and in 1986 the Pickering NGS A discharge was not fished.

Since 1988 was the final year of the Pickering NGS B aquatic studies, comparisons of fish catch data collected from 1979 though 1988 are included in this report.

In addition to the above studies, a fish discharge residency study and a condenser cooling water intake entrainment study were conducted in 1988. The results of these studies will be presented in separate reports.

The Pickering NGS B postoperational aquatic studies were requested by the Environmental Studies and Assessment Department of the Design and Development Division - Generation on behalf of the Pickering Engineering Department.

1.1 Objectives

The objectives of the studies included in the postoperational program were based on hypotheses identified at a workshop held with the purpose of designing the Pickering NGS B postoperational studies (Greig et al 1986).

The objective of the juvenile and adult fish survey was to provide data for the interpretation of gross changes in the fish community. In addition, the information will be used to assess effects of the operation of Pickering NGS B on the fish community. The results will ultimately be compared to data collected during the preoperational and interim studies in an effects report.

The hypothesis for the round whitefish spawning study is that the Pickering NGS thermal plume and water intake will decrease round whitefish populations through hatch advancement and entrainment of larvae. It was suggested that this hypothesis is likely valid but that more information on the spatial distribution and historical populations of round whitefish in the area is required to test it. The objective of the present study was to monitor the relative abundance of round whitefish from Pickering NGS to Thickson Point during their spawning period as an indicator of the relative abundance of the spawning stocks.

1.2 Study Area

The study area covered a 15.5 km stretch of Lake Ontario shoreline from the Pickering NGS A discharge in the west to Thickson Point in the east (Figure 1). Transects fished during the juvenile and adult fish survey were the Pickering NGS A discharge, Pickering NGS B discharge, Duffin Creek and Simcoe Point. Transects fished during the round whitefish spawning study were the Pickering NGS A discharge, Pickering NGS B discharge, Simcoe Point, Richardson Point, Whitby West and Thickson Point.

The 3 m locations on the transects were marked with Geotechnical and Hydraulic Engineering spars. Offshore locations were identified using a compass and depth sounder, as well as shore markers.

2.0 METHODS

2.1 Juvenile and Adult Fish Survey

Juvenile and adult fish were sampled monthly along transects at the Pickering NGS A discharge, the Pickering NGS B discharge, Duffin Creek and Simcoe Point using beach seines and trap nets from May through October and gill nets from May through November.

Triplicate beach seine hauls, using 15-m seines, were taken after dusk once a month. Monthly trap netting effort consisted of setting paired, 1.2-m trap nets perpendicular to shore at the 3 m depth for two consecutive 24-hour sets. Gill nets were set monthly at the 3 and 12 m depth (inshore end) for two consecutive 24-hour sets. Exceptions to this fishing sequence included the May Pickering NGS A 3 m set, which consisted of 1 set only because the first set had been vandalized. A second set at this same location could not be set in November due to prohibitive wave action while the first set at 12 m along this transect could not be retrieved and was left in for 48 hours. Gill nets consisted of eight, multi-filament nylon, 15-m panels with mesh size increasing in 1.3 cm increments from 3.8 to 12.7 cm.

Fish were identified to species and counted. Stomach analysis was conducted on subsamples of salmonids that were killed in the gill nets to determine the forage fish that they prey on. Fork lengths and weights of salmonids killed in the nets were recorded and scales were collected for submission to the Ontario Ministry of Natural Resources. Salmonids captured alive were tagged with Floy spaghetti tags and released to determine whether these fish are long term residents of the study area.

The station operating conditions during the fishing periods are presented in Table 1. Either six or seven units were operational on all but one fishing occasion, the November gill netting, when eight units were operational.

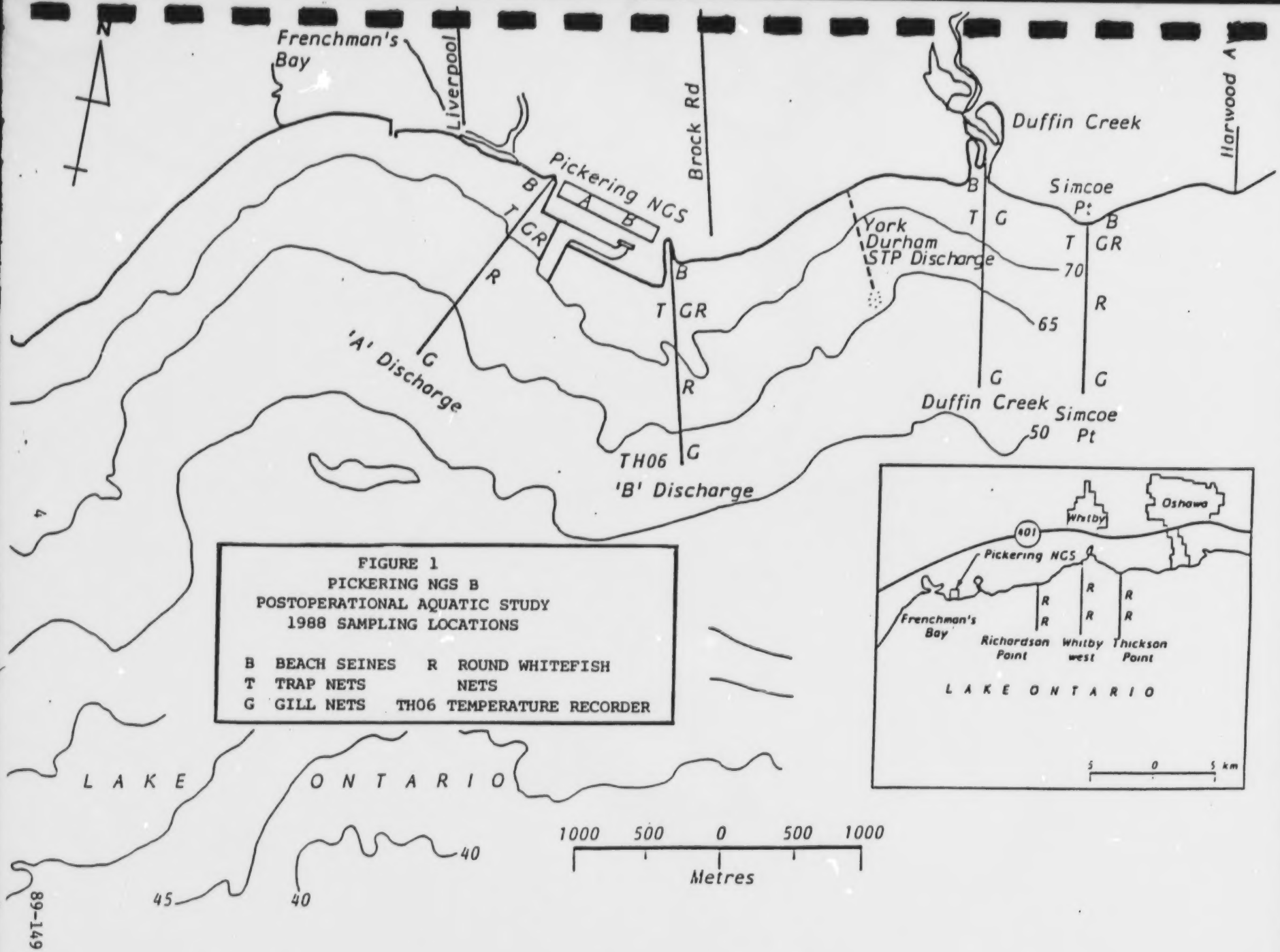


FIGURE 1
PICKERING NGS B
POSTOPERATIONAL AQUATIC STUDY
1988 SAMPLING LOCATIONS

B	BEACH SEINES	R	ROUND WHITEFISH NETS
T	TRAP NETS		
G	GILL NETS	TH06	TEMPERATURE RECORDER

TABLE 1

STATION OPERATING CONDITIONS
DURING 1988 FISHING PERIODS

	UNITS							
	1	2	3	4	5	6	7	8
BEACH SEINES								
MAY 18	X	0	X	X	X	X	X	0
JUNE 14	X	0	X	X	X	X	X	0
JULY 13	X	0	X	X	X	X	X	X
AUG 10	X	0	X	X	X	X	X	X
SEPT 14	X	0	X	X	X	X	X	X
OCT 15	X	0	0	X	X	X	X	X
TRAP NETS								
MAY 16-18	X	0	X	X	X	X	X	0
JUNE 13-15	X	0	X	X	X	X	X	0
JULY 12-14	X	0	X	X	X	X	X	X
AUG 8-10	X	0	X	X	X	X	X	X
SEPT 12-14	X	0	X	X	X	X	X	X
OCT 11-13	X	0	0	X	X	X	X	X
GILL NETS								
MAY 11-12	X	0	X	X	X	X	X	X
MAY 13	X	0	X	X	X	X	X	0
JUNE 6-8	X	0	X	X	X	X	X	0
JULY 4-6	0	0	X	X	X	X	X	0
AUG 2-4	X	0	X	X	X	X	X	X
SEPT 6-8	X	0	X	X	X	X	X	X
OCT 3-5	X	0	0	X	X	X	X	X
NOV 1-3	X	X	X	X	X	X	X	X

0 - NOT OPERATING
X - OPERATING

2.2 Round Whitefish Spawning Study

During the 1988 round whitefish spawning investigations fishing was conducted weekly for five weeks, between November 22 and December 21. Transects fished were the Pickering NGS A discharge, the Pickering NGS B discharge, Simcoe Point, Richardson Point, Whitby West and Thickson Point. Due to adverse weather conditions, Richardson Point, Whitby West and Thickson Point were not fished in the fourth week. The gill nets were set perpendicular to shore along the bottom at the 3 and 7 m depths (inshore end of nets) for one 24-hour period per week. The nets were identical to those used in the juvenile and adult fish survey. Round whitefish fork lengths were recorded and scales collected for age and growth determinations. The age and growth data will be presented in a summary report on the Pickering NGS B round whitefish spawning investigations.

3.0 RESULTS AND DISCUSSION

3.1 Water Temperature

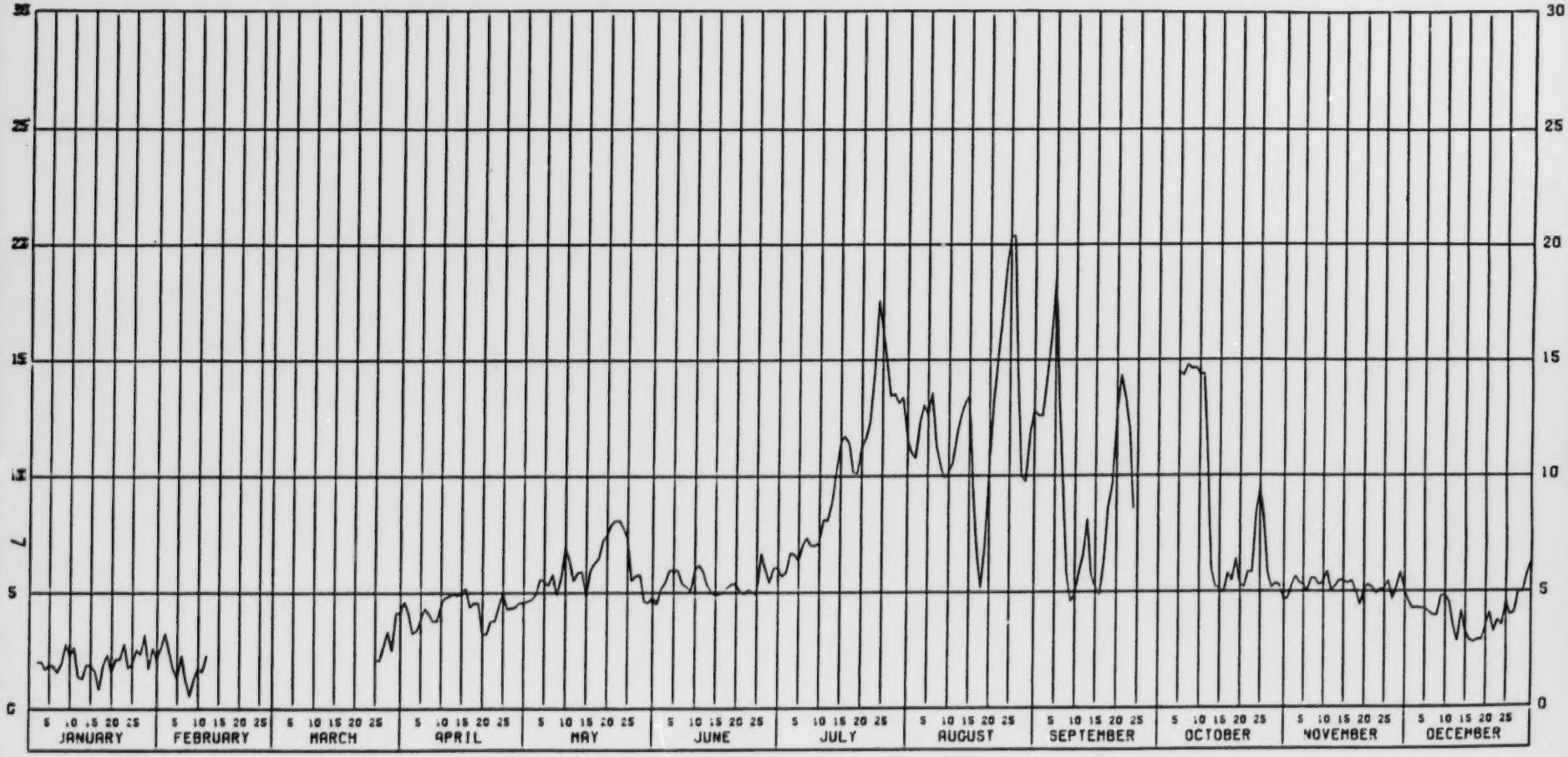
Daily mean water temperatures recorded offshore from the Pickering NGS B discharge at a depth of 12 m (Figure 2, Geotechnical and Hydraulic Engineering location TH06) indicated gradual warming of the water from April to late May. A drop in the temperatures in early-June, which resulted in slightly lower temperatures in June than in May was followed by gradual warming of the water through July. The maximum mean daily temperature of 20 ^{o}C was recorded on August 26. Sharp drops in temperature, characteristic of upwellings, occurred several times during the summer and early fall. An upwelling in late-July followed by an upwelling in mid-August, before temperatures had returned to normal, resulted in very low temperatures of less than 6 ^{o}C. Upwellings also occurred in late-August and mid-September and were underway during the August and September, beach seining, trap netting and gill netting periods. The water temperature dropped in mid-October and remained low for the rest of the year.

3.2 Juvenile and Adult Fish Survey

In this section, monthly fish catches are described by gear type. The data are compared to the results of the 1979-1981 preoperational studies as well as the 1982-1985 interim studies. However, comparison with the interim studies are limited to that of average catches for May, August and November, since those were the only months in which fishing was conducted in 1982-1985.

In the Pickering NGS B study area, as at other locations along the shores of Lake Ontario, the seasonal occurrence of fish are affected by upwelling activity. As a result the seasonality of the various fish species may vary considerably among years, depending on the occurrences of these upwellings, making comparisons of seasonal abundances difficult. This should be kept in mind when reading the fish survey section.

Complete 1988 fish catch data for beach seines are presented in Appendix I, for trap nets in Appendix II, and gill nets in Appendix III. The common and scientific names of the fish are presented in Appendix IV.



LEGEND

WATER TEMPERATURE IN DEGREES CELSIUS

FIGURE 2
MEAN DAILY TEMPERATURES AT THE 12 M DEPTH OFFSHORE
FROM THE PICKERING NGS B DISCHARGE
(GEOTECHNICAL AND HYDRAULIC ENGINEERING LOCATION TH06) IN 1988

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Temperatures recorded during fishing are presented in Appendix V for beach seining, Appendix VI for trap netting and in Appendix VII for gill netting. Maximum, minimum and average daily temperatures obtained from continuous temperatures recorded by the Geotechnical and Hydraulic Engineering Department of Design and Development Division - Generation, at the 3 m locations on the four transects are presented in Appendix VIII.

Beach Seines

Beach seines sampled juvenile and forage fish present in the shallow inshore zone. A total of 1104 fish belonging to 24 species were taken in 72 beach seine hauls (Table 2). Alewife (*Alosa pseudoharengus*) was the most abundant species taken by beach seine, making up 54% of the total catch, followed by emerald shiner (*Notropis atherinoides*) which made up 21% of the catch. Among the more common species in the remainder of the catch were spottail shiner (*Notropis hudsonius*), longnose dace (*Rhinichthys cataractae*) and rainbow smelt (*Osmerus mordax*).

The species composition of the fish of the shallow inshore areas have stayed relatively constant since 1979. Alewife was the most abundant species in this habitat in the preoperational studies as well as in the first years of the postoperational study. With the exception of lake trout (*Salvelinus namaycush*) in 1986 and gizzard shad (*Dorosoma cepedianum*) in 1987, the more common species taken by beach seine during the pre- and postoperational studies were similar.

The seasonal distribution of beach seine catches differed somewhat among years although largest number of fish were most often taken in June. Beach seine catch was highest in June in 1988, when largest numbers of alewife and emerald shiner were taken, and was also highest in June in 1979 and 1986. In 1980 and 1981 maximum numbers were caught in August and May, respectively, while in 1987, when June beach seining was missed, maximum numbers were taken in August.

In 1988, species diversity was highest in June when 14 species were identified in the catch and lowest in May and July when fish belonging to 8 species were taken.

Longnose dace was the most common species present in the May and October catches and alewife was the most common species in all the remaining months except July, when spottail shiner was more abundant.

Alewife was part of the beach seine catch from May to October. They peaked in June when they were most abundant at Duffin Creek. As in previous years, the seasonal distribution of the alewife in the study area coincides with Graham's (1957) description of the inshore spawning migration of alewife in Lake Ontario. Alewife move inshore from April through July, arriving in greatest numbers in June. The adults leave inshore areas immediately following spawning and start migrating back to deeper waters in late August.

TABLE 2

NUMBER AND PER CENT COMPOSITION OF FISH CAUGHT
BY BEACH SEINES - PICKERING NGS B 1988

	MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		TOTAL	
	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
No of Sets	12		12		12		12		12		12		72	
ALEWIFE	1	3.70%	358	59.47%	2	3.85%	161	55.71%	66	66.67%	4	11.43%	592	53.6%
EMERALD SHINER	6	22.22%	200	33.22%	11	21.15%	8	2.77%	4	4.04%	3	8.57%	232	21.0%
SPOTTAIL SHINER	0	0.00%	1	0.17%	16	30.77%	83	28.72%	4	4.04%	0	0.00%	104	9.4%
LONGNOSE DACE	11	40.74%	7	1.16%	13	25.00%	3	1.04%	8	8.08%	15	42.86%	57	5.2%
RAINBOW SMELT	1	3.70%	10	1.66%	0	0.00%	7	2.42%	9	9.09%	2	5.71%	29	2.6%
COMMON SHINER	5	18.52%	8	1.33%	0	0.00%	0	0.00%	2	2.02%	1	2.86%	16	1.4%
YELLOW PERCH	0	0.00%	1	0.17%	3	5.77%	12	4.15%	0	0.00%	0	0.00%	16	1.4%
WHITE PERCH	0	0.00%	1	0.17%	0	0.00%	7	2.42%	1	1.01%	1	2.86%	10	0.9%
RAINBOW TROUT	1	3.70%	4	0.66%	1	1.92%	0	0.00%	0	0.00%	0	0.00%	6	0.5%
BROWN TROUT	1	3.70%	5	0.83%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	6	0.5%
GIZZARD SHAD	0	0.00%	0	0.00%	0	0.00%	0	0.00%	2	2.02%	3	8.57%	5	0.5%
CARP	0	0.00%	2	0.33%	1	1.92%	1	0.35%	1	1.01%	0	0.00%	5	0.5%
LAKE CHUB	0	0.00%	0	0.00%	5	9.62%	0	0.00%	0	0.00%	0	0.00%	5	0.5%
SMALLMOUTH BASS	0	0.00%	0	0.00%	0	0.00%	2	0.69%	0	0.00%	2	5.71%	4	0.4%
SLIMY SCULPIN	0	0.00%	3	0.50%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	3	0.3%
WHITE SUCKER	0	0.00%	0	0.00%	0	0.00%	2	0.69%	1	1.01%	0	0.00%	3	0.3%
PUMPKINSEED	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	3	8.57%	3	0.3%
LOGPERCH	0	0.00%	0	0.00%	0	0.00%	2	0.69%	0	0.00%	0	0.00%	2	0.2%
UNIDENTIFIED CYPRINID	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	1.01%	0	0.00%	1	0.1%
BROWN BULLHEAD	0	0.00%	1	0.17%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.1%
FRESHWATER DRUM	0	0.00%	0	0.00%	0	0.00%	1	0.35%	0	0.00%	0	0.00%	1	0.1%
FATHEAD MINNOW	1	3.70%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.1%
CHINOOK SALMON	0	0.00%	1	0.17%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.1%
CREEK CHUB	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	2.86%	1	0.1%
	27	100.00%	602	100.00%	52	100.00%	289	100.00%	99	100.00%	35	100.00%	1104	100.0%

Emerald shiner was also present in the beach seine catch from May to October and was also most abundant in June when they were taken in highest numbers at Duffin Creek. Spottail shiner were taken by beach seine from June to September with maximum catch taken in August when they were present in largest numbers at Duffin Creek. Similar scenarios were obtained for emerald shiner and spottail shiner in 1979 and 1980, respectively.

Beach seine catch was highest at Duffin Creek where the average catch-per-unit-effort (CUE) was 31.2 fish/seine (Table 3). Largest number of fish were also taken at this location in 1979, 1984, 1985, 1986 and 1987. Species that were caught in largest numbers at Duffin Creek included: alewife, emerald shiner, spottail shiner and rainbow smelt. Species diversity was also highest at Duffin Creek with some species such as creek chub, fathead minnow and brown bullhead taken exclusively at this location. The beach at Duffin Creek is more extensive than at the other three locations, with a gradual incline. These features may provide a more desirable and extensive habitat for fish of shallow inshore areas.

The total beach seine CUE's for the postoperational studies were substantially lower than they were for the preoperational studies (Table 4) and reflected, to some degree, a drop in the average catch of alewife. Alewife catch was highest in 1981 (36.8 fish/haul) and was lowest in 1987 (4.6 fish/haul). Emerald shiner CUE, which had dropped below the range obtained during the preoperational study in 1986 and 1987, increased in 1988 to a high of 3.9 fish/haul. Spottail shiner catch in 1986 and 1987 had also dropped below its preoperational levels but recovered somewhat in 1988 (1.7 fish/haul). Rainbow smelt and gizzard shad average catches fluctuated between years with lowest CUE obtained in 1988. White bass which had been either absent or taken in very low numbers during the preoperational study and in 1986, and had increased near the discharges in 1987, was absent from the 1988 catch.

To allow for comparison of 1979-1988 data, the CUE for May and August only, the months in which beach seining was conducted during the interim studies, are presented in Table 5. The drop in the inshore fish densities of the study area suggested by the May to October CUE was obvious in the 1982 beach seine catch. May and August CUE for 1982-1988 were all below the range obtained in 1979-1981. With the exception of 1979, alewife and rainbow smelt 1982-1988 CUE's were lower than they were during the preoperational studies.

Trap nets

The trap nets sampled fish of the inshore habitat to a depth of 3m. A total of 3748 fish belonging to 18 species were taken in 96 nets (Table 6). Alewife was the most abundant species in the catch and made up 83% of the catch, followed by brown bullhead (*Ictalurus nebulosus*) and white sucker (*Catostomus commersoni*) which made up 6% of the catch each. White perch (*Morone americana*), carp (*Cyprinus carpio*), and yellow perch (*Perca flavescens*) were among the more common species in the remainder of the catch.

TABLE 3

AVERAGE BEACH SEINE CATCH (FISH/HAUL) ALONG FOUR TRANSECTS - PICKERING NGS B

TOTAL	PICKERING NGS A DISCHARGE (18 HAULS)	PICKERING NGS B DISCHARGE (18 HAULS)	DUFFIN CREEK (18 HAULS)	SIMCOE POINT (18 HAULS)
ALEWIFE	6.9	0.9	14.7	10.3
EMERALD SHINER	0.2	4.2	8.3	0.2
SPOTTAIL SHINER	1.5	0.0	4.2	0.1
LONGNOSE DACE	0.9	0.8	0.3	1.2
RAINBOW SMELT	0.0	0.4	0.9	0.2
YELLOW PERCH	0.0	0.2	0.6	0.1
COMMON SHINER	0.1	0.0	0.8	0.0
WHITE PERCH	0.4	0.0	0.2	0.0
BROWN TROUT	0.0	<0.1	0.3	0.0
RAINBOW TROUT	0.2	<0.1	0.1	0.0
CARP	0.2	0.0	<0.1	0.0
GIZZARD SHAD	0.0	0.1	0.2	0.0
LAKE CHUB	0.2	0.0	0.0	<0.5
SMALLMOUTH BASS	0.0	<0.1	0.2	0.0
SLIMY SCULPIN	0.0	0.0	0.1	<0.1
PUMPKINSEED	0.0	0.2	0.0	0.0
WHITE SUCKER	0.0	0.0	<0.1	0.1
LOGPERCH	0.0	<0.1	<0.1	0.0
CREEK CHUB	0.0	0.0	<0.1	0.0
UNIDENTIFIED CYPRINID	0.0	0.0	<0.1	0.0
FATHEAD MINNOW	0.0	0.0	<0.1	0.0
BROWN BULLHEAD	0.0	0.0	<0.1	0.0
FRESHWATER DRUM	0.1	0.0	0.0	0.0
CHINOOK SALMON	0.1	0.0	0.0	0.0
TOTAL	10.8	7.0	31.2	12.3

TABLE 4

COMPARISON OF PICKERING NGS B PREOPERATIONAL AND POSTOPERATIONAL MAY TO OCTOBER BEACH SEINE CATCHES

	1979	1980	1981	1986	1987	1988
	AVERAGE CATCH PER HAUL					
BROWN BULLHEAD	<0.1	<0.1	1.5	0.1	<0.1	<0.1
RAINBOW SMELT	1.3	7.6	1.0	0.6	3.0	0.5
SPOTTAIL SHINER	2.8	3.2	1.2	0.4	1.1	1.7
ALEWIFE	18.0	14.1	36.8	11.3	4.6	9.9
WHITE PERCH	0.2	0.1	0.5	0.2	0.1	0.2
GIZZARD SHAD	4.8	0.4	6.6	<0.1	3.0	<0.1
YELLOW PERCH	1.1	0.9	<0.1	0.0	0.4	0.3
LONGNOSE DACE	0.7	0.7	0.8	1.2	0.7	1.0
RAINBOW TROUT	0.1	0.1	<0.1	0.6	0.0	0.1
FATHEAD MINNOW	<0.1	1.5	1.0	<0.1	<0.1	<0.1
WHITE SUCKER	2.2	0.9	0.5	<0.1	0.0	<0.1
EMERALD SHINER	1.5	2.2	1.2	0.4	0.8	3.9
BLUNTNOSE MINNOW	<0.1	0.3	<0.1	<0.1	0.0	0.0
WHITE BASS	0.0	<0.1	<0.1	<0.1	0.6	0.0
TOTAL NUMBER	3954	3478	4386	1106	888	1104
AVERAGE CATCH PER HAUL	47.7	33.4	60.9	15.4	14.8	15.3
NUMBER OF SPECIES	24	28	29	21	23	24
NUMBER OF HAULS	72	72	72	72	60	72

TABLE 5

PICKERING NGS B

COMPARISON OF BEACH SEINE MAY AND AUGUST CUE - 1979-1981, 1984-1985 AND 1986-1989

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
BROWN BULLHEAD	0.0	0.1	1.9	0	0	0	0	<0.1	<0.1	0.0
RAINBOW SMELT	0.9	20.6	27.7	6.6	0.5	0.0	3.2	1.2	6.6	0.3
SPOTTAIL SHINER	6.8	3.5	0.5	0.4	0.7	5.3	2.6	0.4	0.4	3.5
ALEWIFE	1.7	67.0	51.0	2.0	5.6	0.5	0.1	3.4	9.1	6.8
WHITE PERCH	0.1	0.2	<0.1	<0.1	0.0	0.0	<0.1	0.4	0.1	0.3
GIZZARD SHAD	13.1	1.2	<0.1	0.0	<0.1	0.2	<0.1	0.0	6.0	0.0
YELLOW PERCH	0.9	2.0	<0.1	0.1	<0.1	0.2	0.3	0.0	0.0	0.5
LONGNOSE DACE	0.3	1.3	<0.1	0.9	1.8	1.3	1.0	0.8	1.1	0.6
RAINBOW TROUT	0.0	<0.1	0.0	0.3	<0.1	0.0	0.2	1.0	0.0	<0.1
FATHEAD MINNOW	0.0	1.5	0.0	0.0	0.4	<0.1	<0.1	0.0	0.0	<0.1
WHITE SUCKER	3.9	0.4	0.2	0.0	0.2	<0.1	0.0	<0.1	0.0	<0.1
EMERALD SHINER	8.7	0.5	0.7	<0.1	<0.1	0.6	0.0	0.3	0.8	0.6
BLUNTNOSE MINNOW	<0.1	1.8	<0.1	0.0	<0.1	0.3	0.0	0.0	0.0	0.0
WHITE BASS	0.0	<0.1	<0.1	0.0	<0.1	1.0	0.0	<0.1	0.9	0.0
TOTAL	38.7	132.8	84.5	11.6	10.9	10.9	9.2	10.4	25.5	13.2
NO OF HAULS	17	20	23	24	24	24	24	24	24	24

TABLE 6

NUMBER AND PER CENT COMPOSITION OF FISH CAUGHT
BY TRAP NETS - PICKERING NGS B

	MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		TOTAL	
	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
No of Sets	16		16		16		16		16		16			
ALEWIFE	303	79.74%	483	88.46%	1366	97.43%	949	73.34%	11	16.18%	1	1.72%	3113	83.06%
BROWN BULLHEAD	1	0.26%	0	0.00%	13	0.93%	213	16.46%	0	0.00%	3	5.17%	230	6.14%
WHITE SUCKER	52	13.68%	54	9.89%	16	1.14%	47	3.63%	29	42.65%	17	29.31%	215	5.74%
WHITE PERCH	11	2.89%	1	0.18%	2	0.14%	40	3.09%	15	22.06%	14	24.14%	83	2.21%
CARP	0	0.00%	1	0.18%	0	0.00%	22	1.70%	1	1.47%	4	6.90%	28	0.75%
YELLOW PERCH	7	1.84%	0	0.00%	1	0.07%	6	0.46%	8	11.76%	5	8.62%	27	0.72%
ROCK BASS	1	0.26%	0	0.00%	3	0.21%	8	0.62%	0	0.00%	2	3.45%	14	0.37%
WHITE BASS	3	0.79%	2	0.37%	1	0.07%	2	0.15%	1	1.47%	1	1.72%	10	0.27%
BROWN TROUT	0	0.00%	1	0.18%	0	0.00%	0	0.00%	1	1.47%	6	10.34%	8	0.21%
SMALLMOUTH BASS	0	0.00%	0	0.00%	0	0.00%	3	0.23%	1	1.47%	1	1.72%	5	0.13%
PUMPKINSEED	0	0.00%	0	0.00%	0	0.00%	2	0.15%	0	0.00%	2	3.45%	4	0.11%
AMERICAN EEL	1	0.26%	0	0.00%	0	0.00%	1	0.08%	0	0.00%	0	0.00%	2	0.05%
GIZZARD SHAD	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	2	3.45%	2	0.05%
LAKE CHUB	1	0.26%	0	0.00%	0	0.00%	1	0.08%	0	0.00%	0	0.00%	2	0.05%
ROUND WHITEFISH	0	0.00%	2	0.37%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	2	0.05%
LAKE TROUT	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	1.47%	0	0.00%	1	0.03%
LONGNOSE SUCKER	0	0.00%	1	0.18%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.03%
RAINBOW SMELT	0	0.00%	1	0.18%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.03%
TOTAL	380	100.00%	546	100.00%	1402	100.00%	1294	100.00%	68	100.00%	58	100.00%	3748	100.00%

The most common species in the trap net catches varied little among years. Alewife was the main species taken in all years except 1980, when brown bullhead was more abundant. Otherwise, brown bullhead and white sucker were the second and third most abundant in all remaining years except 1981, when more rainbow smelt were caught than white sucker.

Trap net catch was highest in July in all three postoperational studies. In 1979 and 1980, trap net catch was highest in May and in 1981 it was highest in June. In 1988 species diversity was lowest in July when 7 species were identified in the catch and highest in August and October when 12 species were taken.

Alewife dominated the trap net catch from May through August. White sucker dominated in September and October, following the drop in alewife numbers. Both species were part of the trap net catch throughout the May to October study period.

Alewife catch increased from May though July when it peaked. Alewife numbers remained high in August, dropped of sharply in September and remained low in October. During the preoperational studies and in 1986 and 1987, alewife were also part of the trap net catch throughout the fishing season and were taken in highest numbers between May and July. The seasonal distribution of this species in the study area reflects its spawning migration pattern.

At the time of its peak occurrence in July, alewife were more abundant at the discharge locations than at the remaining two locations, with highest numbers taken at the Pickering NGS A discharge (674, Appendix II).

Brown Bullhead catch peaked in August, when they were most abundant at the Pickering NGS A discharge (Appendix II). In previous study years maximum seasonal catch of brown bullhead was found to vary considerably, occurring in any month between May and September.

During the second trap netting set in August, an upwelling was approaching the study area from the east, and by the second day bottom temperatures at the Pickering NGS A trap netting location (Appendix VI) were warmer than at the remaining locations. Temperatures at the Pickering NGS A discharge (3 m) were 17.5-18.2 ^{o}C compared to 12.1-13.2 ^{o}C at the remaining locations. Thus the warmer waters of the Pickering NGS A discharge during this upwelling may have attracted the brown bullhead to this location.

No seasonal pattern was apparent in the trap net catch of white sucker, although lowest numbers were taken in July and October. White perch were taken in highest numbers in August. Maximum seasonal catch of this species in previous years varied considerably occurring anytime from July to October.

Trap net catch was highest at the Pickering NGS B discharge (Table 7). Alewife were concentrated at the Pickering NGS B discharge in August accounting for the large average CUE obtained for this location. The only other year in which alewife trap net catch was highest at the Pickering NGS B discharge was in 1986. In 1979 alewife catch was highest at Duffin Creek, in

TABLE 7

AVERAGE TRAP NET CATCH (FISH/NET) ALONG FOUR TRANSECTS - PICKERING NGS B, 1987

	PICKERING NGS A DISCHARGE (16 NETS)	PICKERING NGS B DISCHARGE (16 NETS)	DUFFINS CREEK (16 NETS)	SIMCOE POINT (16 NETS)
ALEWIFE	49.2	102.8	26.2	16.4
WHITE SUCKER	3.3	4.2	2.9	3.1
BROWN BULLHEAD	12.2	0.2	1.6	0.4
WHITE PERCH	3.1	1.3	0.3	0.6
CARP	1.7	0.0	<0.1	0.0
YELLOW PERCH	<0.1	0.4	1.0	0.2
ROCK BASS	0.3	0.0	0.3	0.3
BROWN TROUT	0.1	0.3	0.1	0.0
WHITE BASS	0.5	0.0	<0.1	<0.1
SMALLMOUTH BASS	0.3	0.0	0.0	0.0
AMERICAN EEL	0.0	0.1	0.0	0.0
PUMPKINSEED	0.2	0.0	<0.1	0.0
LAKE CHUB	<0.1	0.0	0.0	<0.1
RAINBOW SMELT	0.0	<0.1	0.0	0.0
ROUND WHITEFISH	0.1	0.0	0.0	0.0
GIZZARD SHAD	0.0	<0.1	<0.1	0.0
LAKE TROUT	<0.1	0.0	0.0	0.0
LONGNOSE SUCKER	0.0	0.0	<0.1	0.0
TOTAL	71.2	109.3	32.7	21.1

1980 at Simcoe Point and in 1981 and 1987 it was highest at the Pickering NGS A discharge. White sucker were also taken in highest numbers at the Pickering NGS B discharge.

Brown bullhead was taken in highest numbers at the Pickering NGS A discharge, where it was also taken in highest numbers in trap nets in all previous study years. White perch and white bass were also most abundant in the Pickering NGS A discharge trap net catch as they were in 1986 and 1987. Smallmouth bass, pumpkinseed, round whitefish, lake trout, white perch and carp were all taken in highest numbers in trap nets set at the Pickering NGS A discharge where species diversity was highest. The presence of the warm water species in highest numbers at the Pickering NGS A discharge may be related to temperature since bottom temperature at this location was higher than at the remaining locations in all months except October (Appendix VI). In that month, white perch were only caught at the Pickering NGS B discharge and Simcoe Point. With the exception of May, white perch were taken in highest numbers or exclusively at the Pickering NGS A discharge. A similar observation was made in 1987, when larger numbers of the warm water species were also caught at the Pickering NGS A discharge, where temperatures were higher on most of the trap netting occasions.

Yellow perch was taken in highest numbers at Duffin Creek in all three postoperational study years.

Average trap net catch in 1979-1981 and 1986-1988 reflected average alewife catch. Alewife catch dropped between 1979 and 1980 to a low of 7.1 fish/net, increased through 1986 to a high of 121.9 fish net, and then dropped off again in 1986 and 1988 (Table 8). Rainbow smelt catch was lower during the postoperational years than during the preoperational years and was <0.1 fish/net for a second consecutive year in 1988. White sucker average catch during the postoperational studies was either lower or at the lower range of their preoperational average catches. Brown bullhead CUE, which was highest in 1981, declined between 1986 and 1988 to a low of 2.4 fish/net. Yellow perch trap net catch was lower during the postoperational years than it had been during the preoperational years with lowest catch obtained in 1988. Postoperational CUE's for white perch were just slightly lower than their preoperational CUE's. Pumpkinseed average catch was lower in 1988 than it was in previous years, while white bass catch, which was up from the previous years in 1987, dropped back down to their former levels.

As with the beach seine data, May and August trap net CUE are presented for 1979-1988 (Table 9) to allow for a comparison that includes the interim studies. In this comparison, rather than a drop in CUE between 1979 and 1980, the average catch increased. For May, August and November, CUE was lowest in 1979 and highest in 1980. Since seasonal catches differed among years, a May-August-November survey may hit or miss peak and/or low catches. Therefore, a comparison of CUE based on a three-month survey is not as meaningful as that based on a seven-month survey. The CUE of alewife in these months was higher in 1979 and 1982-1984 than in the remaining months. Rainbow smelt catch dropped and stayed low from 1983-1987, recovering somewhat in 1988. Brown bullhead and yellow perch average catches were higher in 1980 and 1981 than in the remaining years.

TABLE 8

COMPARISON OF PICKERING NGS B PREOPERATIONAL AND POSTOPERATIONAL MAY TO OCTOBER TRAP NET CATCHES

	1979	1980	1981	1986	1987*	1988*
	AVERAGE CATCH PER NET					
ALEWIFE	24.3	7.1	86.1	121.9	53.0	32.4
RAINBOW SMELT	0.5	2.4	6.3	0.1	<0.1	<0.1
WHITE SUCKER	2.1	3.7	3.2	2.4	1.4	2.2
BROWN BULLHEAD	16.2	7.5	52.7	12.7	5.3	2.4
YELLOW PERCH	1.1	3.4	3.4	0.6	0.7	0.3
WHITE PERCH	1.2	1.0	1.0	0.7	0.9	0.9
PUMPKINSEED	0.6	0.1	0.3	0.1	0.6	<0.1
WHITE BASS	0.3	<0.1	0.3	0.1	0.8	0.1
TOTAL NUMBER CAUGHT	5332.0	3281.0	14799.0	15653.0	6102.0	3748.0
AVERAGE CATCH PER NET	47.6	25.8	154.2	139.8	64.2	39.0
NUMBER OF SPECIES	17	21	16	20	18	18
NUMBER OF NETS FISHED	112	127	96	112	95	96

* November data missing

TABLE 9

PICKERING NGS B
COMPARISON OF TRAP NET MAY, AUGUST AND NOVEMBER CUE - 1979-1981, 1984-1985 AND 1986-1988

	1979	1980*	1981*	1982	1983	1984	1985	1986	1987*	1988*
ALEWIFE	57.9	17.3	36.7	100.7	72.8	63.7	6.9	42.4	20.0	39.1
RAINBOW SMELT	1.1	8.3	17.4	2.2	<0.1	<0.1	0.1	0.2	0.2	3.1
WHITE SUCKER	4.5	7.6	3.3	4.6	3.5	2.5	5.4	1.3	1.3	3.1
BROWN BULLHEAD	6.9	30.5	75.1	7.5	13.5	5.7	6.1	6.7	4.1	6.7
YELLOW PERCH	1.1	6.9	5.6	0.8	0.3	0.3	0.4	0.7	1.0	0.4
WHITE PERCH	0.9	3.8	0.9	1.0	0.6	0.4	0.5	0.8	1.8	1.6
PUMPKINSEED	0.4	0.3	<0.1	0.0	<0.1	0.1	0.2	0.1	1.3	<0.1
WHITE BASS	0.2	<0.1	<0.1	0.4	0.1	0.3	1.0	0.1	0.7	0.2
TOTAL	206.5	73.4	140.8	118.0	91.8	74.1	21.1	54.2	31.3	52.3
NO OF NETS	43	29	28	48	48	48	48	48	32	32

* May and August only

Gill nets

The gill nets sampled fish inhabiting the bottom strata at depths of 3 to 14 m. A total of 18711 fish belonging to 25 species were taken in 107 gill nets (Table 10). As in the beach seine and trap net catches, alewife was the most abundant species in the gill net catch, making up 87% of the total catch. It was followed by white sucker which made up 4% of the catch, and brown trout (*Salmo trutta*) and lake trout (*Salvelinus namaycush*) which made up 2% of the catch each. Other species that were among the more common in the remainder of the catch included round whitefish (*Prosopium cylindraceum*) and white perch. All of these six species were part of the gill net catch from May through November.

Alewife was the most abundant species taken by gill net in all pre- and postoperational years. During the preoperational studies, either rainbow smelt or white sucker were the second or third most abundant, while in the first two postoperational studies either white sucker or lake trout were the second or third most abundant. In 1988, brown trout was the third most abundant species. Although brown trout had been more abundant than lake trout in the 1979-1981 catches, 1988 was the only postoperational year in which brown trout was more abundant than lake trout. This was a result of a simultaneous drop in lake trout catch and an increase in brown trout catch in 1988. Of the three fishing gear types, the species composition in the gill nets has changed the most, with substantial increases in the relative abundances of fish of recreational value such as lake trout, brown trout and coho salmon between the pre- and postoperational years.

Monthly catches were dominated by alewife from May through October and lake trout dominated in November.

Seasonal variation in total catch reflected alewife abundance and was high in May, declined somewhat in June-July and peaked in August. Alewife catch dropped in October and only a single alewife was caught in November. As in previous years, the seasonal distribution of alewife in the 1988 gill net catches coincided with its spawning migration pattern in Lake Ontario.

In the 1988 survey, white sucker was taken in highest numbers in July-August. As in past years, gill net catch was highest in months following their May-June spawning period suggesting that most of the white sucker move into the study area following spawning in a nearby stream or along the lake shore.

Brown trout catch fluctuated slightly throughout the study period. The seasonality of lake trout in 1988 demonstrated its preference for cold water, with highest numbers taken in November and lowest in August. In 1987, they were absent from the August catch and also taken in highest numbers in November. In 1986, an upwelling was underway during the August gill netting period and a large number of lake trout were collected, although the November catch was still somewhat higher than the August catch.

TABLE 10

NUMBER AND PER CENT COMPOSITION OF FISH CAUGHT
BY GILL NETS - PICKERING NGS B, 1988

	MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		TOTAL	
	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
No of Sets	15		16		16		16		14		16		14		107	
ALEWIFE	3807	91.25%	2526	92.80%	2616	90.36%	5285	91.53%	1809	85.69%	256	37.26%	1	0.29%	16300	87.11%
WHITE SUCKER	95	2.28%	76	2.79%	172	5.94%	155	2.68%	74	3.51%	69	10.04%	63	18.00%	704	3.76%
BROWN TROUT	84	2.01%	47	1.73%	22	0.76%	74	1.28%	39	1.85%	81	11.79%	30	8.57%	377	2.01%
LAKE TROUT	39	0.93%	10	0.37%	38	1.31%	9	0.16%	70	3.32%	37	5.39%	133	38.00%	336	1.80%
ROUND WHITEFISH	45	1.08%	41	1.51%	21	0.73%	35	0.61%	28	1.33%	26	3.78%	34	9.71%	230	1.23%
WHITE PERCH	30	0.72%	17	0.62%	4	0.14%	18	0.31%	27	1.28%	71	10.33%	42	12.00%	209	1.12%
GIZZARD SHAD	11	0.26%	0	0.00%	3	0.10%	45	0.78%	3	0.14%	15	2.18%	25	7.14%	102	0.55%
RAINBOW SMELT	29	0.70%	3	0.11%	5	0.17%	32	0.55%	8	0.38%	14	2.04%	0	0.00%	91	0.49%
BROWN BULLHEAD	9	0.22%	0	0.00%	0	0.00%	26	0.45%	17	0.81%	16	2.33%	0	0.00%	68	0.36%
WHITE BASS	1	0.02%	0	0.00%	2	0.07%	19	0.33%	6	0.28%	18	2.62%	9	2.57%	55	0.29%
YELLOW PERCH	2	0.05%	0	0.00%	1	0.03%	15	0.26%	6	0.28%	23	3.35%	7	2.00%	54	0.29%
CARP	0	0.00%	0	0.00%	3	0.10%	2	0.03%	8	0.38%	23	3.35%	0	0.00%	36	0.19%
CHINOOK SALMON	0	0.00%	0	0.00%	2	0.07%	0	0.00%	3	0.14%	25	3.64%	2	0.57%	32	0.17%
RAINBOW TROUT	1	0.02%	0	0.00%	0	0.00%	27	0.47%	1	0.05%	0	0.00%	0	0.00%	29	0.15%
COHO SALMON	0	0.00%	0	0.00%	0	0.00%	23	0.40%	0	0.00%	1	0.15%	0	0.00%	24	0.13%
LONGNOSE SUCKER	17	0.41%	1	0.04%	1	0.03%	0	0.00%	1	0.05%	0	0.00%	0	0.00%	20	0.11%
LAKE WHITEFISH	1	0.02%	1	0.04%	0	0.00%	1	0.02%	4	0.19%	4	0.58%	0	0.00%	11	0.06%
FRESHWATER DRUM	0	0.00%	0	0.00%	1	0.03%	3	0.05%	2	0.09%	2	0.29%	1	0.29%	9	0.05%
SMALLMOUTH BASS	1	0.02%	0	0.00%	4	0.14%	1	0.02%	1	0.05%	2	0.29%	0	0.00%	9	0.05%
ROCK BASS	0	0.00%	0	0.00%	0	0.00%	1	0.02%	4	0.19%	1	0.15%	0	0.00%	6	0.03%
WALLEYE	0	0.00%	0	0.00%	0	0.00%	1	0.02%	0	0.00%	1	0.15%	1	0.29%	3	0.02%
LAKE CHUB	0	0.00%	0	0.00%	0	0.00%	1	0.02%	0	0.00%	0	0.00%	1	0.29%	2	0.01%
NORTHERN PIKE	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.15%	1	0.29%	2	0.01%
PUMPKINSEED	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.15%	0	0.00%	1	0.01%
SPLAKE	0	0.00%	0	0.00%	0	0.00%	1	0.02%	0	0.00%	0	0.00%	0	0.00%	1	0.01%
TOTAL	4172	100.00%	2722	100.00%	2895	100.00%	5774	100.00%	2111	100.00%	687	100.00%	350	100.00%	18711	100.00%

Slightly higher numbers of round whitefish were caught in May and June than in the remaining months. The presence of round whitefish in the study area throughout the May to November fishing period is consistent with its description as a shallow water species in the Great Lakes (Scott and Crossman 1973).

Coho salmon were taken exclusively in August, while 27 of the 29 rainbow trout caught in 1988 were taken in August. The only splake caught was also taken in August. The occurrence of these cold water species, as well as lake trout, in the study area in August was probably related to an upwelling which started in late July and persisted though early August (Figure 2). Bottom temperatures during the August survey were as low as 11.0 ^{o}C (Appendix VII).

Average total gill net catch reflected alewife average catch and was highest at Simcoe Point (Table 11). The location where largest numbers of alewife were taken by gill net varied among years; however, in none of the years were largest numbers ever taken in the Pickering NGS B discharge. At the time of its peak occurrence, alewife were more abundant in the shallow sets than in the deep sets at Duffin Creek and Simcoe Point. The opposite was true along the two discharge locations.

White sucker, as in previous years, was most abundant at Duffin Creek. Lake trout, which in 1984-1987 had been found in increasing numbers from the west to the east of the study area, with highest numbers consistently taken at Simcoe Point, were taken in higher numbers at Duffin Creek in 1988. However, lowest numbers were once again taken at the Pickering NGS A discharge followed by the Pickering NGS B discharge. Brown trout catch was highest at the Pickering NGS A discharge as it had been in all previous study years with the exception of 1979. This species was taken in higher numbers in the shallow sets in all months except August when they were more abundant in the deep sets.

Average catches of round whitefish, white perch, gizzard shad, white bass, carp, coho salmon, chinook salmon and lake whitefish were all highest at the Pickering NGS A discharge. Of these species, white perch, gizzard shad, white bass and carp were all more abundant in the inshore nets while round whitefish was more abundant in the offshore nets. Round whitefish and gizzard shad catches were also highest at this location during the preoperational studies as well as in 1986 and 1987. White perch and white bass were also more abundant at the Pickering NGS A discharge during all three years of preoperational studies.

With the exception of August, bottom temperatures at the 3 m depth were slightly higher at the Pickering NGS A and/or Pickering NGS B discharges than at the remaining two locations. The preference of some of the warm water species for the Pickering NGS A discharge could therefore, at least in part, be related to temperature.

Average CUE of the more common fish taken by gill net during the pre- and postoperational studies are presented in Table 12. As in the cases of the beach seine and trap net catches, average total gill net catch reflected the average catches of Alewife, which dropped substantially between 1979 and 1980,

TABLE 11

AVERAGE GILL NET CATCH (FISH/NET) AT 3 AND 12 M DEPTHS ALONG FOUR TRANSECTS
PICKERING NGS B, 1988

	PICKERING NGS A DISCHARGE		PICKERING NGS B DISCHARGE		DUFFIN CREEK		SIMCOE POINT	
DEPTH	3 M	12 M	3 M	12 M	3 M	12 M	3 M	12 M
(NO OF NETS)	(11)	(13)	(13)	(14)	(14)	(14)	(14)	(14)
ALEWIFE	44.5	178.7	73.8	178.9	128.6	150.8	190.3	246.4
GIZZARD SHAD	5.7	0.2	0.9	0.0	2.2	<0.1	0.4	0.0
COHO SALMON	0.0	1.0	<0.1	0.2	0.1	0.4	0.0	0.0
CHINOOK SALMON	0.0	2.4	0.0	0.0	0.0	0.0	0.0	<0.1
RAINBOW TROUT	0.4	0.2	0.0	0.1	0.9	0.1	<0.1	0.4
BROWN TROUT	8.0	4.6	6.4	0.4	6.0	1.7	1.6	0.7
LAKE TROUT	1.5	1.7	2.3	4.6	4.2	3.4	3.0	3.9
LAKE WHITEFISH	0.0	0.6	0.0	0.0	<0.1	0.0	<0.1	<0.1
ROUND WHITEFISH	0.7	8.2	0.5	0.9	1.7	4.0	0.4	0.8
RAINBOW SMELT	0.0	3.1	0.4	0.9	0.6	0.6	0.5	0.6
NORTHERN PIKE	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LONGNOSE SUCKER	0.0	0.0	0.0	0.0	0.8	0.0	0.4	0.3
WHITE SUCKER	9.2	5.5	4.9	2.4	15.8	3.7	8.7	2.8
LAKE CHUB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
CARP	0.7	1.2	0.2	0.0	0.6	0.0	0.1	0.0
BROWN BULLHEAD	0.4	0.2	0.2	0.0	3.0	<0.1	1.1	0.0
WHITE PERCH	6.9	0.5	4.3	0.4	2.3	0.6	1.4	0.3
WHITE BASS	1.6	0.2	0.9	0.6	0.5	<0.1	0.4	<0.1
ROCK BASS	0.0	0.0	<0.1	0.0	0.0	<0.1	0.3	0.0
SMALLMOUTH BASS	0.0	0.0	0.2	<0.1	0.3	0.0	0.1	0.0
YELLOW PERCH	1.3	0.5	0.5	<0.1	1.0	0.5	0.4	0.0
WALLEYE	0.0	0.0	0.2	0.0	<0.1	0.0	0.0	0.0
PUMPKINSEED	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FRESHWATER DRUM	<0.1	0.0	<0.1	0.0	0.2	0.0	0.1	0.1
SPLAKE	0.6	<0.1	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	80.1	208.7	96.0	189.6	169.0	166.1	209.4	256.6

TABLE 12

COMPARISON OF PICKERING NGS B PREOPERATIONAL AND POSTOPERATIONAL MAY-NOVEMBER GILL NET CATCHES

	1979	1980	1981	1986	1987	1988
			AVERAGE CATCH PER NET			
ALEWIFE	160.8	85.4	97.9	134.2	196.4	152.3
RAINBOW SMELT	16.1	4.8	8.9	0.9	0.8	0.9
WHITE SUCKER	8.7	4.8	6.6	6.0	6.8	6.6
BROWN BULLHEAD	2.7	0.7	0.6	<0.1	1.2	0.6
YELLOW PERCH	2.2	3.0	1.3	0.5	2.7	0.5
WHITE PERCH	1.4	2.0	0.4	3.5	1.8	2.0
GIZZARD SHAD	4.7	1.1	3.6	1.5	1.8	1.0
ROUND WHITEFISH	0.8	0.6	1.2	2.0	1.7	2.1
BROWN TROUT	0.2	0.4	0.5	1.6	2.6	3.5
LAKE TROUT	0.0	<0.1	0.0	7.3	4.2	3.1
WHITE BASS	0.4	0.2	0.7	0.2	0.5	0.5
COHO SALMON	<0.1	<0.1	<0.1	0.2	0.6	0.2
TOTAL NUMBER CAUGHT	19739	15352	15894	17763	24749	18711
AVERAGE CATCH PER NET	199.4	103.7	124.2	158.6	222.3	174.9
NUMBER OF SPECIES	22	26	25	27	27	25
NUMBER OF NETS FISHED	99	148	128	112	111	107

increased steadily between 1980 and 1987 to 196.4 fish/net, and then dropped in 1988 to 152.3 fish/net (Figure 3). Rainbow smelt catch declined between 1979 and 1980, and then recovered somewhat in 1981 (Figure 3). However, during the postoperational studies smelt CUE was very low in all three years (<1.0 fish/net). White sucker catch remained relatively constant over the six years of pre- and postoperational studies. Average catch of brown bullhead was highest in 1979 and lowest in 1980. In the remaining years it was relatively constant. Yellow perch catch fluctuated somewhat between years with highest average catch in 1980 and lowest average catch in 1986 and 1988. White perch catch was lowest in 1981 and highest in 1986 (Figure 3). The average catches of gizzard shad and white bass for the postoperational years were within the ranges obtained during the preoperational studies.

Average catches of lake trout, brown trout, round whitefish and coho salmon were all higher in the postoperational years than in the preoperational years (Figure 4). Lake trout catch increased from a CUE of 0 to <0.1 in 1979-1981 to a high of 7.3 in 1986, dropping off subsequently to 3.1 in 1988. Brown trout catch increased steadily between 1979 and 1988, from 0.2 to 3.5 fish/net. Average catch of round whitefish was highest in 1988 while coho salmon average catch was highest in 1987. The increase in lake and brown trout is a result of steady stocking since the early 1970's (Ontario Ministry of Natural Resources unpublished data). Coho salmon have been stocked at a lower level than lake and brown trout since the late 1960's.

The gill net CUE for May, August and November of 1979-1988 are presented in Table 13. Once again, these data are presented to allow for a comparison of gill net catch including the interim studies. Due to the differences in seasonal catches among years, which are very much affected by frequent upwellings, a comparison of May-August-November surveys is not as reliable as a comparison of May-November, monthly surveys. The CUE for the three months was lowest in 1979 and highest in 1980. Average catch of alewife was lowest in 1979 and highest in 1988. Rainbow smelt was highest in 1982, then dropped off and remained low through 1987, increasing slightly in 1988. Round whitefish catch increased between 1979 and 1988, with highest average catch obtained in 1988. CUE of brown trout, absent from the May-August-November catch in 1979, increased to 3.9 in 1988. The three-month catch data suggests that the increase in lake trout numbers in the study area started in 1982, peaked in 1986 and then dropped off somewhat in 1987 and 1988.

In 1984 and 1985, when lake trout catch was starting to increase notably, alewife still dominated the gill net catch both numerically and in terms of biomass. Although alewife still dominated the gill net catch numerically during the postoperational studies, lake trout dominated in terms of biomass in 1986 and 1987 and co-dominated with brown trout in 1988. The average weight of brown trout increased substantially between 1986 and 1988 from 1.8 to 2.7 kg (N=273, SD=1.39). Lake trout average weight increased from 2.8 in 1986 to 3.0 kg (N=151, SD=1.13) in 1988. The estimated biomass of brown trout in the 1988 gill net catch was 1006.6 kg. Lake trout biomass was 1018.1 kg and alewife biomass was estimated at 487.7 kg.

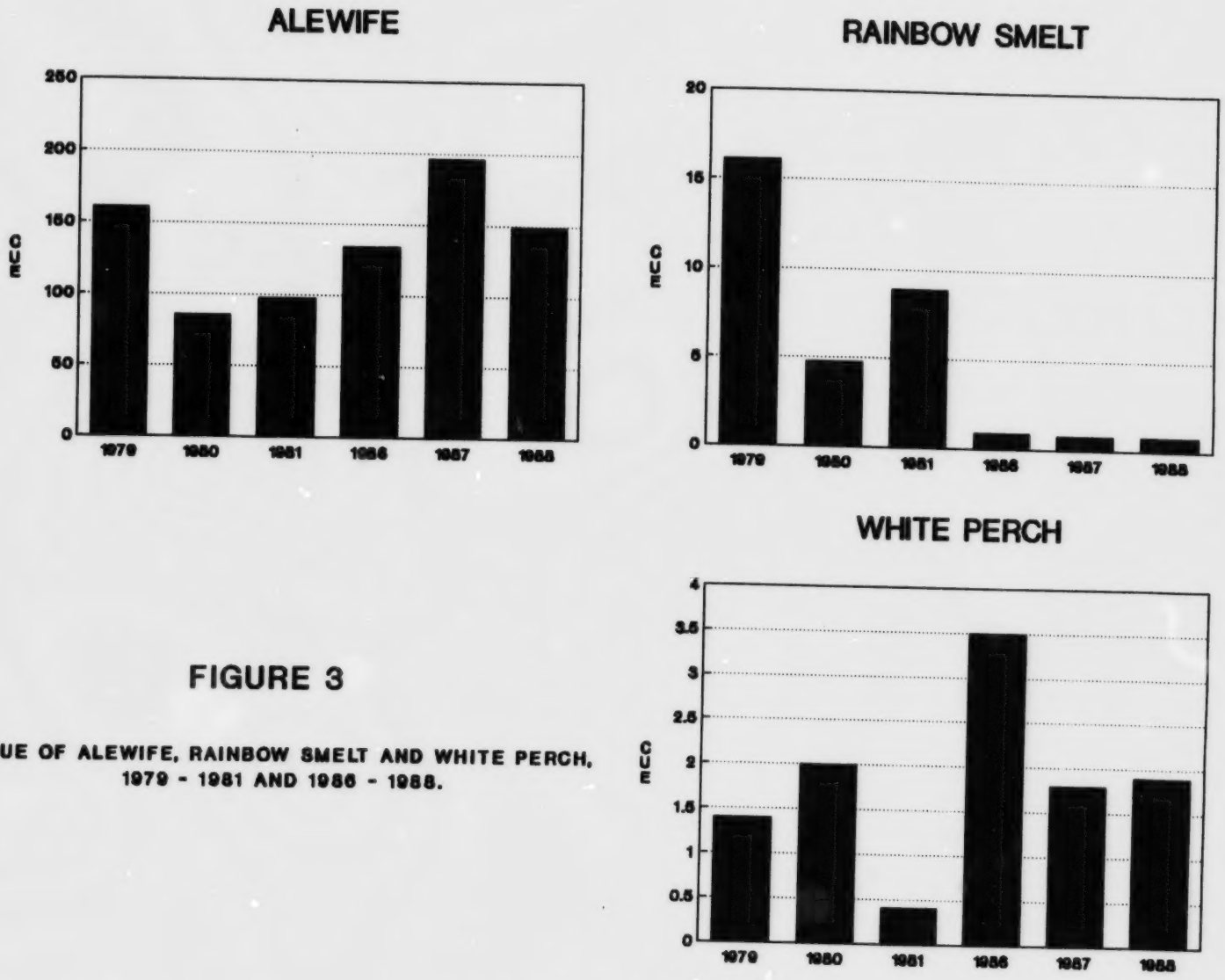

FIGURE 3

CUE OF ALEWIFE, RAINBOW SMELT AND WHITE PERCH, 1979 - 1981 AND 1986 - 1988.

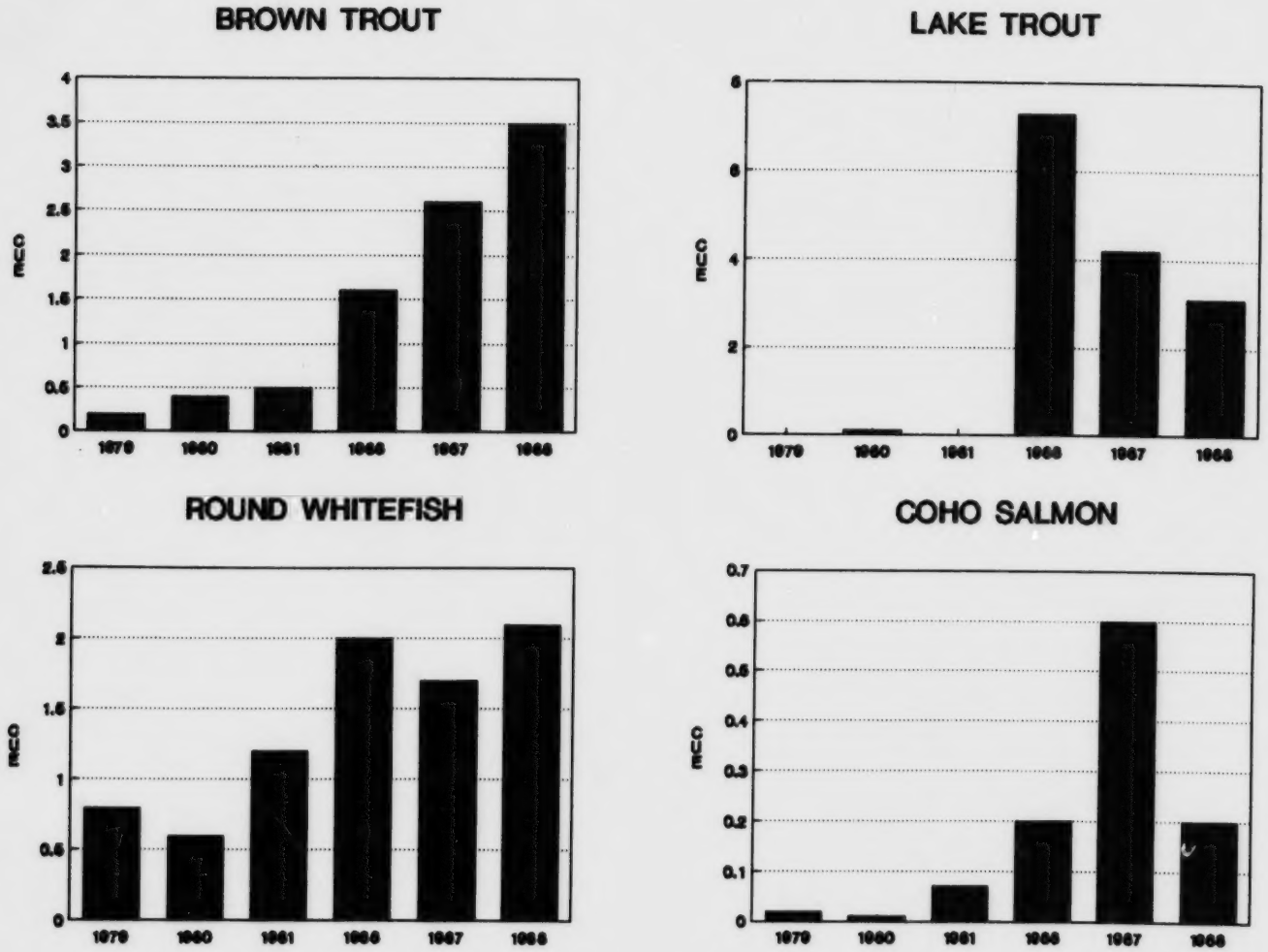

FIGURE 4

ROUND WHITEFISH, BROWN TROUT, LAKE TROUT AND COHO SALMON, 1979 - 1981 AND 1986 - 1988.

TABLE 13

PICKERING NGS B

COMPARISON OF GILL NET MAY, AUGUST AND NOVEMBER CUE - 1979-1981, 1984-1985 AND 1986-1988

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
ALEWIFE	37.0	119.5	90.1	87.3	137.2	170.4	116.5	138.3	88.3	188.6
RAINBOW SMELT	19.6	4.1	7.8	23.5	6.4	2.6	1.5	0.5	0.2	1.3
WHITE SUCKER	8.2	12.4	7.8	9.4	6.5	8.7	9.5	6.1	7.1	6.5
BROWN BULLHEAD	0.1	1.3	0.3	0.0	0.4	1.0	0.9	<0.1	1.5	0.7
YELLOW PERCH	0.7	2.7	1.9	0.2	1.4	1.5	0.3	0.8	2.8	0.5
WHITE PERCH	1.0	1.0	2.4	0.9	1.0	0.6	1.7	6.8	1.8	1.8
GIZZARD SHAD	0.5	0.8	1.2	1.0	3.5	3.1	0.9	3.4	1.6	1.7
ROUND WHITEFISH	0.6	0.2	1.2	1.4	1.1	1.3	2.2	2.0	1.5	2.4
BROWN TROUT	0.0	0.7	0.2	0.7	1.6	1.9	1.9	1.3	3.8	3.9
LAKE TROUT	0.0	<0.1	0.0	0.0	2.1	3.3	3.2	10.3	3.9	3.8
WHITE BASS	0.5	0.4	1.2	19.0	0.2	1.6	0.7	0.4	0.5	0.6
COHO SALMON	<0.1	<0.1	0.0	0.3	<0.1	<0.1	0.9	0.1	<0.1	0.5
TOTAL	70.0	481.6	107.9	127.9	162.5	197.7	140.9	170.8	114.4	213.6
NO OF NETS	48	46	47	48	48	48	48	48	48	48

Salmonid Stomach Analysis

Stomach analyses results are presented in Table 14. The number of occurrences represent the total number of individual prey fish found in the stomachs. Of the salmonids collected for stomach analysis between April and December of 1988, 50% of the Lake trout had contents, as well as 45% of the brown trout, 53% of the rainbow trout and 70 % of the coho salmon.

Rainbow smelt was the most common prey species present in the lake trout stomachs, making up 65% of the identifiable prey species, followed by sculpin and alewife. In addition, several shiners and a single gizzard shad were found in the lake trout stomachs. In 1986, lake trout stomachs contained equal proportions of rainbow smelt and alewife, and a smaller portion of sculpin. Results from 1987 were quite similar to those of 1988.

Identifiable prey species in brown trout stomachs consisted of similar portions of alewife (42%) and rainbow smelt (42%), followed by gizzard shad (14%). Other forage fish found in brown trout stomachs were sculpin (2.5%) and walleye (<0.1%). Brown trout stomachs were only analysed in 1987 and 1988, following the increase in their catch in 1986. In 1987, the proportion of alewife, rainbow smelt and gizzard shad in brown trout stomachs were quite similar.

No identifiable prey species were found in the rainbow trout and coho salmon stomachs.

As in 1987, larger proportions of lake and brown trout had contents in the spring and early summer than in the remaining months, with the exception of December (Table 15). The larger percentage of stomachs with contents in the spring and early summer reflects the seasonal occurrences of rainbow smelt and alewife. The stomach contents of brown trout in December consisted of a large portion of gizzard shad, which were only found in the stomachs of lake and brown trout caught in December.

A slightly larger portion of lake trout taken at Pickering NGS A had stomachs with contents (57%) than at Duffin Creek (42%) and Simcoe Point (50%), with lowest percentage of stomachs with contents obtained from Pickering NGS B (32%). The percentage of brown trout stomachs with content increased from west to east, between Pickering NGS A (48%) and Simcoe Point (63%).

Tagging Program

A tagging program was initiated in 1986 to determine whether lake trout remained in the thermal plume long enough to affect spawning success. The hypothesis that the program was concerned with was that rainbow and lake trout would be attracted to the thermal plume by the availability of forage fish resulting in decreased spawning success of rainbow and lake trout. Rather than limiting the tagging program to rainbow and lake trout, all salmonids taken in the fish survey gill net catch were tagged.

TABLE 14

STOMACH CONTENTS OF LAKE TROUT, BROWN TROUT, RAINBOW TROUT AND COHO SALMON COLLECTED FROM MARCH - DECEMBER, 1988

Species	EMPTY STOMACHS	STOMACHS WITH CONTENTS	UNRECOG-NIZABLE	ALEWIFE	RAINBOW SMELT	GIZZARD SHAD	SHINER	SCULPIN	STICKLE-BACK	WALLEYE
	NUMBER OF ITEMS									
LAKE TROUT	76	75	125	31	119	1	2	30		
BROWN TROUT	122	151	245	83	82	27		5		1
RAINBOW TROUT	10	9	17	17					7	
COHO SALMON	14	6	8							

TABLE 15

STOMACH CONTENT OF LAKE TROUT AND BROWN TROUT BY MONTH.
PICKERING NGS B, 1988

	NO OF STOMACHS	% WITH CONTENT	UNRECOG-NIZABLE	ALEWIFE	RAINBOW SMELT	GIZZARD SHAD	SHINER	SCULPIN	WALLEYE
LAKE TROUT						NUMBER OF ITEMS			
MARCH	16	88	1	1	0	0	0	0	
APRIL	41	71	39	18	52	0	1	2	
MAY	22	64	29	1	24			1	
JUNE	3	100		3	4				
JULY	17	41	33	3	10			27	
AUGUST	10	0							
SEPTEMBER	31	26	6	3	30				
OCTOBER	19	16	4	3					
NOVEMBER			NO STOMACHS ANALYSED						
DECEMBER	5	80	10	2		1	1		
BROWN TROUT									
MARCH	9	89	11	4	6				1
APRIL	18	72	12	14	10				
MAY	60	77	102	27	51				
JUNE	23	57	16	5	5				
JULY	5	60	12						
AUGUST	41	39	26	18					
SEPTEMBER	19	11	4	3					
OCTOBER	21	0	6		2				
NOVEMBER			NO STOMACHS ANALYSED						
DECEMBER	71	55	56	12	8	27			

The number of fish tagged and number of tag returns received are presented in Table 16. A total of 611 lake trout were tagged in 1986 of which 31 tags were returned. Of the 298 lake trout tagged in 1987, 10 returns were received, and of the 195 tagged in 1988 no tags have been returned to date (March, 1989). This is a return of 3.7% over the three-year program. Six of the 41 returns were recaptured by anglers fishing in the Pickering NGS study area while the remaining 35 were recaptured over a wide area, with many returns received from the southern shore of Lake Ontario (Table 17). The results suggest that lake trout are long distance travelers and that the chances of them remaining in the study area are small. Several returns were received from fish caught around generating stations other than Pickering NGS, which may reflect angler effort around generating stations. Since only four of the fish were tagged and recaptured in the study area within the same fall period, it is probably unlikely that a large portion of the lake trout population would remain in the study area and/or the thermal plume for long enough periods to have their sexual maturation affected. Further discussion on lake trout residence in the thermal plume will be presented in a report covering the lake trout radiotelemetry study.

No returns were received from the 15 brown trout tagged in 1986, while eight each of the 298, 1987 brown trout tags and 195, 1988 tags were returned. This return rate (3.9%) is similar to that obtained for the lake trout suggesting similar catchability of the two species. Nine of the 16 brown trout tag returns came from the area around Pickering NGS. With the exception of one return which came from Rochester, New York, the remaining tags came from an area between the Credit River to the west and Cobourg to the east (Table 18). These results suggest that brown trout do not travel as extensively as lake trout, and that there is a chance that some of them would remain in the thermal plume for sufficiently long periods that their sexual maturation and in-turn spawning success may be affected.

Although few smallmouth bass were tagged (42) and only two returns were received, both of these were taken from the Pickering NGS B discharge, suggesting that some of these fish are long term or regular residents of the discharge. Smallmouth bass discharge residency is discussed in detail in the 1987 (Ontario Hydro Research Division Report No 88-267-K) and 1988 fish discharge residency reports (Ontario Hydro Research Division report in draft).

3.3 Round Whitefish Spawning Study

The concern with the round whitefish in the study area is that the Pickering thermal plume will decrease round whitefish populations through egg hatch advancement.

Complete round whitefish data are presented in Appendix IX and temperature recorded at the fishing locations when nets were set and pulled are presented in Appendix X.

A total of 1522 fish belonging to 22 species were taken in 52 nets set weekly from November 22 to December 21, 1988 (Table 19). White perch was the most abundant species in the total catch (25%), followed closely by round whitefish

TABLE 16

NUMBER OF FISH TAGGED AND NUMBER OF TAG RETURNS
IN 1986-1988, PICKERING NGS B POSTOPERATIONAL STUDY

	1986		1987		1988	
	TAGGED	RETURNS	TAGGED	RETURNS	TAGGED	RETURNS
	NUMBERS					
LAKE TROUT	611	31	298	10	195	0
BROWN TROUT	15	0	180	8	220	7
RAINBOW TROUT	1	0	5	0	0	0
SMALLMOUTH BASS	3	0	37	1	2	1
WALLEYE	1	0	1	0	2	0
COHO SALMON					1	0
SPLAKE					1	0
TOTAL	631	31	521	19	421	8

TABLE 17

1986-1988 LAKE TROUT TAG RETURNS

DATE TAGGED	LOCATION TAGGED	DATE RETRIEVED	LOCATION RECAPTURED
OCT 16, 1986	SIMCOE PT 3M	AUG 2, 1987	NINE MILE POINT, NEW YORK
OCT 16, 1986	PK A 3 M	MARCH, 1988	BRONTE, OAKVILLE, ONTARIO
OCT 17, 1986	SIMCOE PT 3M	SEPT 5, 1987	OFF SANDY POND, UTICA, NEW YORK
OCT 17, 1986	SIMCOE PT 3M	SEPT 18, 1988	MOUTH OF GENORASKA RIVER, PORT HOPE, ONTARIO
OCT 17, 1986	SIMCOE PT 3M	SEPT 5, 1987	OLCOTT, NEW YORK
OCT 17, 1986	SIMCOE PT 3M	SEPT 28, 1987	OFF CREDIT RIVER, PORT CREDIT, ONTARIO
OCT 27, 1986	WHITBY 7M	OCT 11, 1988	ROUGE RIVER, SCARBOROUGH, ONTARIO
OCT 27, 1986	WHITBY 7M	JULY, 1987	AT SALMON RIVER, PULASKI, NEW YORK
OCT 27, 1986	WHITBY 7M	JULY 2, 1987	OFF CENTRE ISLAND, TORONTO, ONTARIO
OCT 27, 1986	WHITBY 7M	OCT 14, 1988	MOUTH OF BOWMANVILLE CREEK, BOWMANVILLE, ONTA
OCT 27, 1986	WHITBY 7M	JUNE 17, 1987	SCARBOROUGH BLUFFS, SCARBOROUGH, ONTARIO
OCT 27, 1986	WHITBY 7M	NOV 30, 1987	NIAGARA GLEN, BT WHIRLPOOL AND GENERATING STA
OCT 27, 1986	WHITBY 7M	JUNE 19, 1988	PORT HOPE, ONTARIO
OCT 28, 1986	WHITBY 7M	MAY 4, 1987	MEXICO BAY, MEXICO, NEW YORK
NOV 4, 1986	WHITBY 7M	JULY 12, 1987	OFF HEARN TGS, TORONTO, ONTARIO
NOV 4, 1986	WHITBY 7M	JUNE 20, 1987	BLUFFER'S PARK, SCARBOROUGH, ONTARIO
NOV 4, 1986	WHITBY 7M	JUNE 9, 1987	MOUTH OF CREDIT RIVER, PORT CREDIT, ONTARIO
NOV 4, 1986	WHITBY 7M	JUNE 4, 1988	MARIE CURTIS PARK, LAKEVIEW, ONTARIO
NOV 4, 1986	WHITBY 7M	JULY 6, 1987	LIVERPOOL, NEW YORK
OCT 30, 1986	WHITBY 7M	NOV, 1986	PK NGS STUDY AREA, PICKERING, ONTARIO
OCT 30, 1986	WHITBY 7M	AUG 27, 1988	OAKVILLE CEMENT PLANT, OAKVILLE, ONTARIO
NOV 4, 1986	WHITBY 7M	JULY 26, 1987	COBOURG, ONTARIO
NOV 4, 1986	WHITBY 7M	NOV 18, 1986	PK NGS STUDY AREA, PICKERING, ONTARIO
NOV 4, 1986	WHITBY 7M	NOV, 1987	DARLINGTON, ONTARIO
NOV 4, 1986	WHITBY 7M	JULY, 1988	BLUFFER'S PARK, SCARBOROUGH, ONTARIO
NOV 18, 1986	WHITBY 7M	NOV, 1986	PK NGS STUDY AREA, PICKERING, ONTARIO
NOV 11, 1987	PK A 3M	MAY 22, 1988	WELLESLEY ISLAND, ST LAWRENCE RIVER
NOV 26, 1987	PK A 7M	NOV 28, 1987	PICKERING NGS AT INTAKE, PICKERING, ONTARIO
NOV 11, 1986	WHITBY 7M	APR 26, 1988	PK NGS STUDY AREA, PICKERING, ONTARIO
NOV 11, 1986	WHITBY 7M	APR, 1987	BRIGHTON, ONTARIO
NOV 11, 1986	WHITBY 7M	APR 27, 1987	GINNA POWER STATION, WAYNE COUNTY, NEW YORK
NOV 13, 1986	WHITBY 7M	NOV 13, 1986	PK NGS STUDY AREA, PICKERING, ONTARIO
NOV 11, 1986	WHITBY 7M	NOV 12, 1987	OSHAWA CREEK, OSHAWA, ONTARIO
MAY 13, 1987	DUFFIN CREEK 3M	OCT 4, 1987	WILSON, NEW YORK
OCT 7, 1987	SIMCOE PT 3M	MAY 29, 1988	COBOURG, ONTARIO
OCT 8, 1987	PK A 3M	OCT 11, 1987	5 MI OFFSHORE FROM PK NGS, PICKERING, ONTARIO
OCT 8, 1987	PK A 3M	OCT 11, 1987	5 MI OFFSHORE FROM PK NGS, PICKERING, ONTARIO
OCT 8, 1987	PK A 3M	OCT 11, 1987	5 MI OFFSHORE FROM PK NGS, PICKERING, ONTARIO
OCT 8, 1987	PK B 3M	JULY 10,1988	SCARBOROUGH BLUFFS, SCARBOROUGH, ONTARIO
OCT 8, 1987	DUFFIN CREEK 3M	OCT 18, 1987	AJAX, ONTARIO (DEAD)
OCT 8, 1987	DUFFIN CREEK 3M	AUG 12, 1988	PORT OF OAKVILLE, OAKVILLE, ONTARIO

TABLE 18

1986-1988 BROWN TROUT, RAINBOW TROUT AND SMALLMOUTH BASS TAG RETURNS

DATE TAGGED	LOCATION TAGGED	DATE RETRIEVED	LOCATION RECAPTURED
BROWN TROUT			
DEC 3, 1987	THICKSON PT 7M	MARCH 24, 1988	OFF PK B DISCHARGE, PICKERING, ONTARIO
DEC 8, 1987	THICKSON PT 7M	OCT 7, 1988	BOWMANVILLE CREEK, BOWMANVILLE, ONTARIO
DEC 8, 1987	PK A 3M	MAY 1, 1988	PK NGS, PICKERING, ONTARIO
DEC 9, 1987	PK A 3M	MARCH 27, 1988	PK NGS A, PICKERING, ONTARIO
MAY 13, 1987	SIMCOE PT 3M	JAN 2, 1988	ROCHESTER, NEW YORK
MAY 14, 1987	PK B 3M	JAN 2, 1988	PK NGS AT INTAKE, PICKERING, ONTARIO
JULY 15, 1987	SIMCOE PT 3M	NOV, 1987	CREDIT RIVER AT BURNHAMTHORPE RD, MISSISSAUGA, ONTARIO
OCT 6, 1987	PK A 12M	NOV 15, 1987	PK NGS, PICKERING, ONTARIO
JUNE 7, 1988	PK A 12M	JULY 5, 1988	PK NGS, PICKERING, ONTARIO
MAY 12, 1988	SIMCOE PT 12M	OCT 30, 1988	WILMOT CREEK, ONTARIO
AUG 4, 1988	WHITBY	OCT 27, 1988	FACTORY CREEK, COBOURG, ONTARIO
NOV 23, 1988	PK B	DEC 1, 1988	OSHAWA, ONTARIO
NOV 23, 1988	PK B	DEC, 1988	PICKERING NGS B DISCHARGE, PICKERING, ONTARIO
OCT 5, 1988	DUFFIN 3M	OCT 12, 1988	DUFFINS CREEK, PICKERING, ONTARIO
SEPT 8, 1988	DUFFIN 12M	DEC 21, 1988	PK NGS B, PICKERING, ONTARIO
RAINBOW TROUT			
OCT 16, 1986	PK A 12M	JULY, 1988	NEAR CREDIT RIVER, PORT CREDIT, ONTARIO
SMALLMOUTH BASS			
MAY 25, 1987	PK A	JUNE 6, 1987	PK NGS B DISCHARGE, 1987
AUG 1, 1988	PK B	SEPT 15, 1988	PK NGS B DISCHARGE, PICKERING, ONTARIO

TABLE 19

NUMBER OF FISH CAUGHT BY GILL NETS DURING THE PICKERING NGS B
ROUND WHITEFISH SPAWNING STUDY - 1988

	NOVEMBER 22-23		NOV 29,DEC 2		DECEMBER 7-8-9		DECEMBER 15		DECEMBER 21-22		TOTAL		TOTAL	
	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	NUMBER	%
WHITE PERCH	14	4	111	0	66	1	82	4	91	10	364	19	383	25.16
ROUND WHITEFISH	7	12	17	37	28	43	6	104	15	67	73	263	336	22.08
WHITE BASS	7	2	45	0	65	1	84	1	34	4	235	8	243	15.97
BROWN TROUT	26	17	29	6	32	9	19	15	17	16	123	63	186	12.22
WHITE SUCKER	19	11	19	7	18	13	4	6	13	30	73	67	140	9.20
GIZZARD SHAD	11	0	5	0	7	0	65	2	6	0	94	2	96	6.31
LAKE TROUT	6	6	4	5	6	3	1	4	5	3	22	21	43	2.83
YELLOW PERCH	3	0	8	1	4	1	0	0	4	1	19	3	22	1.45
ALEWIFE	0	0	0	15	0	1	0	0	0	0	0	16	16	1.05
BROWN BULLHEAD	4	0	1	1	0	0	3	0	4	0	12	1	13	0.85
FRESHWATER DRUM	0	0	11	0	0	0	0	0	1	0	12	0	12	0.79
CARP	2	0	1	0	3	0	1	0	3	1	10	1	11	0.72
RAINBOW TROUT	0	0	1	1	1	1	0	0	2	0	4	2	6	0.39
SMALLMOUTH BASS	0	0	1	0	1	0	1	0	0	0	3	0	3	0.20
WALLEYE	0	0	0	0	0	0	0	0	1	2	1	2	3	0.20
SCULPIN	0	0	0	0	1	1	0	0	0	0	1	1	2	0.13
COHO SALMON	2	0	0	0	0	0	0	0	0	0	2	0	2	0.13
CHINOOK SALMON	1	0	0	0	0	0	0	0	0	0	1	0	1	0.07
ROCK BASS	0	0	1	0	0	0	0	0	0	0	1	0	1	0.07
RAINBOW SMELT	0	0	0	0	1	0	0	0	0	0	1	0	1	0.07
LAKE CHUB	0	1	0	0	0	0	0	0	0	0	0	1	1	0.07
NORTHERN PIKE	0	0	0	0	0	0	1	0	0	0	1	0	1	0.07
TOTAL	102	53	254	73	233	74	267	136	196	134	1052	470	1522	100.00

(22%) and then white bass (16%) and brown trout (12%). Round whitefish was the main species present during the round whitefish spawning investigations conducted in previous years (1984-1987).

Brown trout was the most common species taken in the week of November 22 and white perch was the most common species caught in the week of November 29. Round whitefish dominated the catch in the weeks of December 7 and 15 and white perch dominated again in the week of December 21.

Round whitefish catch increased from 19 to 110 between the first and fourth week of fishing and then decreased to 82 in the last week. In past surveys, highest catches of round whitefish have also been taken in early to mid-December.

White perch catch was high in all weeks except the first. Brown and lake trout catches were relatively constant throughout the five weeks of fishing, while white bass catch increased from the first week through the fourth week from 9 to 85 and declined to 38 in the last week.

Total catch was substantially higher at the Pickering NGS B discharge than at the remaining five locations, with 13 species taken in either highest numbers or exclusively at this location (Table 20).

Total round whitefish catch was highest at the Pickering NGS B discharge while weekly catches were highest either at the Pickering NGS B discharge or Thickson Point. The largest single catch of 94 round whitefish was taken at the Pickering NGS B discharge 7 m location in the week of December 15, followed by a catch of 51 round whitefish taken at the same location in the following week. Largest single catches of round whitefish were also taken at this location in 1986 and 1987, the only other two years since 1984 that this location was included in the survey. Most of the round whitefish (78%) were taken in the deep nets (7 m) with no suggestion that further inshore migration was occurring during the study period.

Ripe individuals were caught at all locations except the Whitby West 3 m location. The first ripe individual was taken at the Pickering NGS A 7 m location on December 2. Spent individuals were caught on December 15 and 22 and were taken at all 7 m locations except the Pickering NGS A 7 m location. Along the 3 m depth contour, spent individuals were only caught at Richardson Point. Largest number of ripe individuals were caught on December 15 at the Pickering NGS B 7 m location and largest number of spent individuals were caught at this location on December 22.

A large portion of the round whitefish caught at the Pickering NGS B 7 m location during the spawning study were male suggesting that perhaps the males remain in the study area longer than the females.

The larger number of round whitefish caught at the Pickering NGS B discharge in the last three years suggests this species may be spawning in areas influenced by the thermal plume. Hatch advancement of eggs may occur in these

TABLE 20

ROUND WHITEFISH STUDY - PICKERING NGS B 1988
FISH CATCH BY LOCATION

	PICKERING A DISCHARGE (9 NETS)	PICKERING B DISCHARGE (10 NETS)	SIMCOE POINT (10 NETS)	RICHARDSON POINT (8 NETS)	WHITBY WEST (8 NETS)	THICKSON POINT (8 NETS)
WHITE PERCH	3.1	33.5	1.6	0.0	0.4	0.1
ROUND WHITEFISH	2.2	17.2	3.0	3.1	2.1	9.0
WHITE BASS	0.9	19.8	2.7	0.5	0.3	0.5
BROWN TROUT	2.0	7.1	5.4	1.1	2.5	1.8
WHITE SUCKER	6.3	2.3	2.0	2.0	2.0	1.0
GIZZARD SHAD	1.6	7.7	0.5	0.0	0.0	0.0
LAKE TROUT	0.3	1.1	1.2	0.4	0.8	1.0
YELLOW PERCH	1.6	0.1	0.0	0.0	0.8	0.1
ALEWIFE	0.1	0.0	0.0	1.1	0.8	0.0
BROWN BULLHEAD	0.0	0.5	0.0	0.5	0.4	0.1
FRESHWATER DRUM	0.0	1.2	0.0	0.0	0.0	0.0
CARP	0.3	0.5	0.1	0.0	0.3	0.0
RAINBOW TROUT	0.0	0.3	0.1	0.1	0.0	0.1
SMALLMOUTH BASS	0.0	0.2	0.0	0.0	0.1	0.0
WALLEYE	0.0	0.1	0.0	0.1	0.1	0.0
SCULPIN	0.0	0.0	0.0	0.0	0.0	0.3
COHO SALMON	0.0	0.0	0.2	0.0	0.0	0.0
CHINOOK SALMON	0.0	0.1	0.0	0.0	0.0	0.0
ROCK BASS	0.0	0.1	0.0	0.0	0.0	0.0
RAINBOW SMELT	0.1	0.0	0.0	0.0	0.0	0.0
LAKE CHUB	0.0	0.1	0.0	0.0	0.0	0.0
NORTHERN PIKE	0.0	0.1	0.0	0.0	0.0	0.0
TOTAL	18.6	92.0	16.8	9.0	10.4	14.0

areas in the spring (Ontario Hydro Research Division Report No 87-181-K) and, if the assumptions of the hypothesis are correct, may result in the long term decline of the round whitefish population (Greig et al 1986).

Besides round whitefish, species that were taken in highest numbers at the Pickering NGS B discharge included brown trout, white perch and white bass. Of these three species, only white perch were consistently more abundant at the Pickering NGS B discharge in all five weeks. A larger number of brown trout were taken at 3 m (66%) than at 7 m, while most of the white perch (95%) and white bass (97%) were taken in the shallow sets. The thermal plume only extended to the bottom at the 3 m Pickering NGS B discharge location during the second week of fishing on December 1. This suggests that temperature is not the main reason for the large presence of these species at the Pickering NGS B discharge 3 m location. However, the larger numbers at this location may reflect the numbers of fish entering or leaving the thermal discharge where bottom temperatures can be expected to be higher than ambient.

The average catch of round whitefish, including all locations fished during the 1988 survey, was 6.3. This was lower than it had been for the five locations (excluding Pickering NGS A) fished in 1986 (7.6) and for the six locations fished in 1987 (8.3). To compare the postoperational average catches with those of the interim studies, only the catches at Whitby West and Thickson Point were used. From 1979 to 1981, round whitefish CUE was less than 2.1. In 1982 and 1983, it was less than 4.0 and in 1984 and 1985 they were 6.4 and 8.4, respectively. During the postoperational studies the average catches were 5.8, 9.8 and 5.6, in 1986, 1987 and 1988, respectively. Although the 1988 CUE was the lowest of the interim and postoperational studies, it was still substantially higher than it had been during the preoperational studies.

4.0 SUMMARY

Beach seine catch suggests that the species composition of the fish of the shallow inshore areas of the Pickering NGS B study area has stayed relatively constant since 1979. Alewife was the most abundant species in the 1988 beach seine catch as it was in the 1979-1981 preoperational studies and in the first two years of the postoperational studies conducted in 1986-1987. As in most previous Pickering NGS B surveys, beach seine catch was highest at Duffin Creek. The May-October postoperational beach seine CUE's were lower than they had been during the preoperational studies. The May-August-November CUE's for 1979-1988 indicates that the drop in beach seine catch started in 1982.

Alewife was the most abundant species in the 1988 trap net catch as it had been in all previous study years except 1980, when brown bullhead were more abundant. Otherwise, brown bullhead and white sucker were the second and third most abundant in the trap net catches in all years except 1981, when rainbow smelt were more abundant than white sucker. The location at which highest trap net catch was taken has varied among years, with highest CUE in 1988 obtained at Pickering NGS B. Brown bullhead has consistently been taken in highest numbers in the Pickering NGS A discharge since 1979. White perch and white bass were taken in highest numbers in the Pickering NGS A discharge in all three postoperational years. May-November trap net CUE's were higher

in 1981 and 1986 and lower in 1980 and 1988 than in the remaining years. Trap net total CUE declined through the postoperational years, although it was still within the range obtained during the preoperational study.

Alewife dominated the gill net catch numerically in all study years. However, lake trout, whose CUE had increased substantially since 1983, dominated the catch in terms of biomass in 1986 and 1987, and co-dominated with brown trout in 1988. Brown trout CUE increased steadily between 1979 and 1988 while that of coho salmon increased to 1987 and declined somewhat in 1988. The average catches of lake trout, brown trout, coho salmon and round whitefish were all substantially higher for the postoperational studies than for the preoperational studies. The increase in abundance of lake and brown trout were a result of steady stocking since the early 1970's. Coho salmon have been stocked at a lower level than lake and brown trout since the late 1960's.

As in 1987, 1988 stomach analyses indicated that lake trout consumed mainly rainbow smelt, followed by sculpin and alewife. Brown trout stomach analyses during 1988 indicated that they preyed equally on rainbow smelt and alewife and to a lesser degree on gizzard shad. During 1987, brown trout stomach analyses indicated a larger consumption of alewife than rainbow smelt. The percentage of stomachs with contents reflected the seasonal occurrence of the prey species in the study area. A larger proportion of stomachs had contents in the spring and early summer when rainbow smelt and alewife were more abundant in the study area. Gizzard shad were only found in stomachs of lake and brown trout collected in December.

A tagging program was carried out during the postoperational years with the objective of determining whether salmonids remained in the thermal plume for long enough periods that their spawning success might be affected. The results suggest that lake trout are long distance travelers and that the chances of them remaining in the study area are small. Thus it is unlikely that this species would remain in the thermal plume for long enough periods to have their sexual maturation affected. The brown trout returns suggest that they do not travel as extensively as lake trout and that there is a chance that some of them would remain in the thermal plume for sufficiently long periods that their sexual maturation and spawning success may be affected.

The concern with the round whitefish in the study area is that the Pickering thermal plume will decrease round whitefish populations through egg hatch advancement. Although round whitefish was the most abundant species present in the total catch during previous round whitefish spawning surveys conducted from mid-November through mid-December, white perch was the main species taken in 1988, followed by round whitefish. Round whitefish was the most common taxon taken in the weeks of December 7 and 15, 1988. As in previous years, round whitefish were most abundant in mid-December, suggesting a mid-December peak spawning period. Largest total number of round whitefish as well as largest single catch of round whitefish were taken at the Pickering NGS B discharge as they were in 1986 and 1987. This suggests that round whitefish may be spawning in areas affected by the thermal plume, in which case, egg hatch advancement may occur in the spring.

Comparison of 1979-1988 average catches for Whitby West and Thickson Point, the two locations that have been part of the round whitefish spawning investigations since 1979, indicates a drop in CUE in 1988 from 1987. Although the 1988 CUE was the lowest of the interim and postoperational years, it was still substantially higher than it had been during the preoperational period.

The objective of the fish survey was to detect gross changes in the fish community of the study area. The most obvious change has been in the species composition of the gill net catches of the preoperational and postoperational studies. The relative abundances of the salmonids, including lake and brown trout and coho salmon, were substantially higher during the postoperational studies than during the preoperational studies.

5.0 ACKNOWLEDGEMENT

The field program was carried out under the supervision of L.P. King. I wish to acknowledge his significant contribution to all phases of the 1986-1988 Pickering NGS B aquatic biological studies.

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Appendix I

APPENDIX I

PICKERING BEACH SEINES 1988
MAY

	PK A DISCHARGE			PK B DISCHARGE			DUFFIN CREEK			SIMCOE POINT			TOTAL	% CATCH
MAY 20	1	2	3	1	2	3	1	2	3	1	2	3		
ALEWIFE		1											1	3.70%
BLUNTNOSE MINNOW													0	0.00%
BROWN BULLHEAD													0	0.00%
BROWN TROUT							1						1	3.70%
CARP													0	0.00%
CHINOOK SALMON													0	0.00%
COMMON SHINER			2					2	1				5	18.52%
CREEK CHUB													0	0.00%
EMERALD SHINER		1					1	1	2			1	6	22.22%
FRESHWATER DRUM													0	0.00%
FATHEAD MINNOW							1						1	3.70%
GIZZARD SHAD													0	0.00%
LAKE CHUB													0	0.00%
LOGPERCH													0	0.00%
LONGNOSE DACE			3								5	3	11	40.74%
PUMPKINSEED													0	0.00%
RAINBOW SMELT												1	1	3.70%
RAINBOW TROUT								1					1	3.70%
ROCK BASS													0	0.00%
SLIMY SCULPIN													0	0.00%
SMALLMOUTH BASS													0	0.00%
SPOTTAIL SHINER													0	0.00%
WHITE BASS													0	0.00%
WHITE PERCH													0	0.00%
WHITE SUCKER													0	0.00%
YELLOW PERCH													0	0.00%
UNIDENTIFIED CYPRINID													0	0.00%
TOTAL	0	2	5	0	0	0	3	4	3	0	5	5	27	100.00%

APPENDIX I

PICKERING BEACH SEINES 1988
JUNE

	PK A DISCHARGE			PK B DISCHARGE			DUFFIN CREEK			SIMCOE POINT			TOTAL	% CATCH
	1	2	3	1	2	3	1	2	3	1	2	3		
JUNE 14														
ALEWIFE	47	17	41	1	1		80	60	110			1	358	59.47%
BLUNTNOSE MINNOW													0	0.00%
BROWN BULLHEAD							1						1	0.17%
BROWN TROUT				1			1	2	1				5	0.83%
CARP			2										2	0.33%
CHINOOK SALMON			1										1	0.17%
COMMON SHINER							3	2	3				8	1.33%
CREEK CHUB													0	0.00%
EMERALD SHINER				23	30	23	40	48	36				200	33.22%
FRESHWATER DRUM													0	0.00%
FATHEAD MINNOW													0	0.00%
GIZZARD SHAD													0	0.00%
LAKE CHUB													0	0.00%
LOGPERCH													0	0.00%
LONGNOSE DACE				4	1	1				1			7	1.16%
PUMPKINSEED													0	0.00%
RAINBOW SMELT				3	2	2		3					10	1.66%
RAINBOW TROUT	1		2		1								4	0.66%
ROCK BASS													0	0.00%
SLIMY SCULPIN							1		1	1			3	0.50%
SMALLMOUTH BASS													0	0.00%
SPOTTAIL SHINER		1											1	0.17%
WHITE BASS													0	0.00%
WHITE PERCH									1				1	0.17%
WHITE SUCKER													0	0.00%
YELLOW PERCH							1						1	0.17%
UNIDENTIFIED CYPRINID													0	0.00%
TOTAL	48	18	46	32	35	26	127	115	152	2	0	1	602	100.00%

APPENDIX I

PICKERING BEACH SEINES 1988
JULY

JULY 13	PK A DISCHARGE 1	2	3	PK B DISCHARGE 1	2	3	DUFFIN CREEK 1	2	3	SIMCOE POINT 1	2	3	TOTAL	% CATCH
ALEWIFE													0	0.00%
BLUNTNOSE MINNOW										1	1		2	3.85%
BROWN BULLHEAD													0	0.00%
BROWN TROUT													0	0.00%
CARP													0	0.00%
CHINOOK SALMON									1				1	1.92%
COMMON SHINER													0	0.00%
CREEK CHUB													0	0.00%
EMERALD SHINER		1											0	0.00%
FRESHWATER DRUM							4	3	3				11	21.15%
FATHEAD MINNOW													0	0.00%
GIZZARD SHAD													0	0.00%
LAKE CHUB		1	3							1			5	9.62%
LOGPERCH													0	0.00%
LONGNOSE DACE			1	2	2	3	2		1	1	1		13	25.00%
PUMPKINSEED													0	0.00%
RAINBOW SMELT													0	0.00%
RAINBOW TROUT							1						1	1.92%
ROCK BASS													0	0.00%
SLIMY SCULPIN													0	0.00%
SMALLMOUTH BASS													0	0.00%
SPOTTAIL SHINER	4	5	7										16	30.77%
WHITE BASS													0	0.00%
WHITE PERCH													0	0.00%
WHITE SUCKER													0	0.00%
YELLOW PERCH				1			1				1		3	5.77%
UNIDENTIFIED CYPRINID													0	0.00%
TOTAL	4	7	11	3	2	3	8	3	5	3	3	0	52	100.00%

APPENDIX I

PICKERING BEACH SEINES 1988
AUGUST

	PK A DISCHARGE			PK B DISCHARGE			DUFFIN CREEK			SIMCOE POINT			TOTAL	% CATCH
AUG 10	1	2	3	1	2	3	1	2	3	1	2	3		
ALEWIFE	10	3	6	2		12	9	2		6	8	103	161	55.71%
BLUNTNOSE MINNOW													0	0.00%
BROWN BULLHEAD													0	0.00%
BROWN TROUT													0	0.00%
CARP			1										1	0.35%
CHINOOK SALMON													0	0.00%
COMMON SHINER													0	0.00%
CREEK CHUB													0	0.00%
EMERALD SHINER							5	1	2				8	2.77%
FRESHWATER DRUM	1												1	0.35%
FATHEAD MINNOW													0	0.00%
GIZZARD SHAD													0	0.00%
LAKE CHUB													0	0.00%
LOGPERCH					1				1				2	0.69%
LONGNOSE DACE			1				1	1					3	1.04%
PUMPKINSEED													0	0.00%
RAINBOW SMELT						1	1	4			1		7	2.42%
RAINBOW TROUT													0	0.00%
ROCK BASS													0	0.00%
SLIMY SCULPIN													0	0.00%
SMALLMOUTH BASS				1					1				2	0.69%
SPOTTAIL SHINER	7	3					24	33	14	1		1	83	28.72%
WHITE BASS													0	0.00%
WHITE PERCH	7												7	2.42%
WHITE SUCKER							1				1		2	0.69%
YELLOW PERCH					2		7	1	1	1			12	4.15%
UNIDENTIFIED CYPRINID													0	0.00%
TOTAL	25	6	8	3	3	13	48	42	19	8	10	104	289	100.00%

APPENDIX I

PICKERING BEACH SEINES 1988
SEPTEMBER

SEPT 14	PK A DISCHARGE 1	2	3	PK B DISCHARGE 1	2	3	DUFFIN CREEK 1	2	3	SIMCOE POINT 1	2	3	TOTAL	% CATCH
ALEWIFE							3		1	21	14	27	66	66.67%
BLUNTNOSE MINNOW													0	0.00%
BROWN BULLHEAD													0	0.00%
BROWN TROUT													0	0.00%
CARP	1												1	1.01%
CHINOOK SALMON													0	0.00%
COMMON SHINER							2						2	2.02%
CREEK CHUB													0	0.00%
EMERALD SHINER	2									2			4	4.04%
FRESHWATER DRUM													0	0.00%
FATHEAD MINNOW													0	0.00%
GIZZARD SHAD							2						2	2.02%
LAKE CHUB													0	0.00%
LOGPERCH													0	0.00%
LONGNOSE DACE	4	1									1	2	8	8.08%
PUMPKINSEED													0	0.00%
RAINBOW SMELT							3	3	1		2		9	9.09%
RAINBOW TROUT													0	0.00%
ROCK BASS													0	0.00%
SLIMY SCULPIN													0	0.00%
SMALLMOUTH BASS													0	0.00%
SPOTTAIL SHINER							1		3				4	4.04%
WHITE BASS													0	0.00%
WHITE PERCH							1						1	1.01%
WHITE SUCKER										1			1	1.01%
YELLOW PERCH													0	0.00%
UNIDENTIFIED CYPRINID							1						1	1.01%
TOTAL	7	1	0	0	0	0	13	3	5	24	17	29	99	100.00%

APPENDIX I

PICKERING BEACH SEINES 1988
OCTOBER

	PK A DISCHARGE			PK B DISCHARGE			DUFFIN CREEK			SIMCOE POINT			TOTAL	% CATCH
	1	2	3	1	2	3	1	2	3	1	2	3		
OCT 8														
ALEWIFE												4	ERR	ERR
BLUNTNOSE MINNOW													ERR	ERR
BROWN BULLHEAD													ERR	ERR
BROWN TROUT													ERR	ERR
CARP													ERR	ERR
CHINOOK SALMON													ERR	ERR
COMMON SHINER								1					ERR	ERR
CREEK CHUB									1				ERR	ERR
EMERALD SHINER							1	2					ERR	ERR
FRESHWATER DRUM													ERR	ERR
FATHEAD MINNOW													ERR	ERR
GIZZARD SHAD				2				1					ERR	ERR
LAKE CHUB													ERR	ERR
LOGPERCH													ERR	ERR
LONGNOSE DACE	3		4		1					2	4	1	ERR	ERR
PUMPKINSEED				1	1	1							ERR	ERR
RAINBOW SMELT							1		1				ERR	ERR
RAINBOW TROUT													ERR	ERR
ROCK BASS													ERR	ERR
SLIMY SCULPIN													ERR	ERR
SMALLMOUTH BASS								1	1				ERR	ERR
SPOTTAIL SHINER													ERR	ERR
WHITE BASS													ERR	ERR
WHITE PERCH							1						ERR	ERR
WHITE SUCKER													ERR	ERR
YELLOW PERCH													ERR	ERR
UNIDENTIFIED CYPRINID													ERR	ERR
TOTAL	2	4	5	3	2	1	3	5	3	ERR	ERR	ERR	ERR	ERR

Appendix II

APPENDIX II
PICKERING TRAP NETS 1988
MAY

	PK A DIS				PK B DIS				DUFFIN CR				SIMCOE PT				TOTAL E	TOTAL W	TOTAL#	% CATCH
	EAST		WEST		EAST		WEST		EAST		WEST		EAST		WEST					
MAY 17 & 18/88	17	18	17	18	17	18	17	18	17	18	17	18	17	18	17	18				
ALEWIFE	3	2	31	12		41		11	8	134	50	8		2		1	190	113	303	79.74%
GIZZARD SHAD																	0	0	0	0.00%
BROWN TROUT																	0	0	0	0.00%
LAKE TROUT																	0	0	0	0.00%
RAINBOW SMELT																	0	0	0	0.00%
WHITE SUCKER	2	5	6	1		18		2	1		10				4	3	26	26	52	13.68%
CARP																	0	0	0	0.00%
BROWN BULLHEAD						1											1	0	1	0.26%
AMERICAN EEL						1											1	0	1	0.26%
WHITE PERCH		2	1	1		2		3	2								6	5	11	2.89%
WHITE BASS		1	2														1	2	3	0.79%
ROCK BASS															1		0	1	1	0.26%
PUMPKINSEED																	0	0	0	0.00%
SMALLMOUTH BASS																	0	0	0	0.00%
YELLOW PERCH						2	1	2	1		1						3	4	7	1.84%
LAKE CHUB															1		0	1	1	0.26%
LONGNOSE SUCKER																	0	0	0	0.00%
TOTAL	5	10	40	14	0	65	1	18	12	134	61	8	0	2	6	4	228	152	380	100.00%

APPENDIX II
PICKERING TRAP NETS 1988
JUNE

	PK A DIS				PK B DIS				DUFFIN CR				SIMCOE PT				TOTAL E	TOTAL W	TOTAL#	% CATCH
	EAST		WEST		EAST		WEST		EAST		WEST		EAST		WEST					
JUNE 14 & 15/88	14	15	14	15	14	15	14	15	14	15	14	15	14	15	14	15				
ALEWIFE	7	3	23	28	26	5	140	167	9	8	9	9	15	22	9	3	95	388	483	88.46%
GIZZARD SHAD																	0	0	0	0.00%
BROWN TROUT					1												1	0	1	0.18%
LAKE TROUT																	0	0	0	0.00%
RAINBOW SMELT					1												1	0	1	0.18%
WHITE SUCKER	13	5							12		7	2	4	7		4	41	13	54	9.89%
CARP											1						0	1	1	0.18%
BROWN BULLHEAD																	0	0	0	0.00%
AMERICAN EEL																	0	0	0	0.00%
WHITE PERCH	1																1	0	1	0.18%
WHITE BASS	2																2	0	2	0.37%
ROCK BASS																	0	0	0	0.00%
PUMPKINSEED																	0	0	0	0.00%
SMALLMOUTH BASS																	0	0	0	0.00%
YELLOW PERCH																	0	0	0	0.00%
LAKE CHUB																	0	0	0	0.00%
LONGNOSE SUCKER											1						0	1	1	0.18%
ROUND WHITEFISH				2													0	2	2	0.37%
TOTAL	23	8	23	28	28	5	140	167	21	8	18	11	19	29	9	7	141	403	546	100.00%

APPENDIX II
PICKERING TRAP NETS 1984
JULY

	PK A DIS				PK B DIS				DUFFIN CR				SIMCOE PT				TOTAL E	TOTAL W	TOTAL#	% CATCH
	EAST		WEST		EAST		WEST		EAST		WEST		EAST		WEST					
JULY 13 & 14/88	13	14	13	14	13	14	13	14	13	14	13	14	13	14	13	14				
ALEWIFE	158	17	476	23	290	45	133	17	18	6	17	12	44	4	89	17	582	784	1366	97.43%
GIZZARD SHAD																	0	0	0	0.00%
BROWN TROUT																	0	0	0	0.00%
LAKE TROUT																	0	0	0	0.00%
RAINBOW SMELT																	0	0	0	0.00%
WHITE SUCKER			2		1	1		1	2	1	2	1	4			1	9	7	16	1.14%
CARP																	0	0	0	0.00%
BROWN BULLHEAD									1	8	1	2		1			10	3	13	0.93%
AMERICAN EEL																	0	0	0	0.00%
WHITE PERCH		1							1								2	0	2	0.14%
WHITE BASS											1						0	1	1	0.07%
ROCK BASS											1	2					0	3	3	0.21%
PUMPKINSEED																	0	0	0	0.00%
SMALLMOUTH BASS																	0	0	0	0.00%
YELLOW PERCH		1															1	0	1	0.07%
LAKE CHUB																	0	0	0	0.00%
LONGNOSE SUCKER																	0	0	0	0.00%
TOTAL	158	19	478	23	291	46	133	18	22	15	22	17	48	5	89	18	604	798	1402	100.00%

APPENDIX II
PICKERING TRAP NETS 1988
AUGUST

	PK A DIS				PK B DIS				DUFFIN CR				SIMCOE PT				TOTAL E	TOTAL W	TOTAL#	% CATCH
	EAST		WEST		EAST		WEST		EAST		WEST		EAST		WEST					
AUGUST 9 & 10/88	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10				
ALEWIFE			3		600	117	9	41	7	15	32	76	3	38	2	6	780	169	949	73.34%
GIZZARD SHAD																	0	0	0	0.00%
BROWN TROUT																	0	0	0	0.00%
LAKE TROUT																	0	0	0	0.00%
RAINBOW SMELT																	0	0	0	0.00%
WHITE SUCKER			6		30	3				1	1	1			1	4	34	13	47	3.63%
CARP		2	13	7													2	20	22	1.70%
BROWN BULLHEAD			35	159	2				7		6				4		9	204	213	16.46%
AMERICAN EEL						1											1	0	1	0.08%
WHITE PERCH		28		3	7	1						1					36	4	40	3.09%
WHITE BASS				2													0	2	2	0.15%
ROCK BASS		1	1	3											3		1	7	8	0.62%
PUMPKINSEED		1	1														1	1	2	0.15%
SMALLMOUTH BASS	1		1	1													1	2	3	0.23%
YELLOW PERCH					1					5							6	0	6	0.46%
LAKE CHUB				1													0	1	1	0.08%
LONGNOSE SUCKER																	0	0	0	0.00%
TOTAL	1	32	60	176	640	122	9	41	14	21	39	78	3	38	10	10	871	423	1294	100.00%

APPENDIX II
PICKERING TRAP NETS 1988
SEPTEMBER

	PK A DIS				PK B DIS				DUFFIN CR				SINCOE PT				TOTAL E	TOTAL W	TOTAL#	% CATCH
	EAST		WEST		EAST		WEST		EAST		WEST		EAST		WEST					
SEPT. 13 & 14/88	13	14	13	14	13	14	13	14	13	14	13	14	13	14	13	14				
ALEWIFE				1		2			1				5		2		8	3	11	16.18%
GIZZARD SHAD																	0	0	0	0.00%
BROWN TROUT									1								1	0	1	1.47%
LAKE TROUT			1														0	1	1	1.47%
RAINBOW SMELT																	0	0	0	0.00%
WHITE SUCKER		12			6		1	1	1	1	2			1		4	21	8	29	42.65%
CARP				1													0	1	1	1.47%
BROWN BULLHEAD																	0	0	0	0.00%
AMERICAN EEL																	0	0	0	0.00%
WHITE PERCH	8	3	2										2				13	2	15	22.06%
WHITE BASS	1																1	0	1	1.47%
ROCK BASS																	0	0	0	0.00%
PUMPKINSEED																	0	0	0	0.00%
SMALLMOUTH BASS			1														0	1	1	1.47%
YELLOW PERCH									4	2		1			1		6	2	8	11.76%
LAKE CHUB																	0	0	0	0.00%
LONGNOSE SUCKER																	0	0	0	0.00%
ROUND WHITEFISH																			0	0.00%
TOTAL	9	15	4	2	6	2	1	1	7	3	2	1	7	1	3	4	50	18	68	100.00%

APPENDIX II
PICKERING TRAP NETS 1988
OCTOBER

	PK A DIS				PK B DIS				DUFFIN CR				SIMCOE PT				TOTAL E	TOTAL W	TOTAL#	% CATCH
	EAST		WEST		EAST		WEST		EAST		WEST		EAST		WEST					
OCT. 12 & 13/88	12	13	12	13	12	13	12	13	12	13	12	13	12	13	12	13				
ALEWIFE													1				1	0	1	1.72%
GIZZARD SHAD								1		1							1	1	2	3.45%
BROWN TROUT		1	1					3	1								2	4	6	10.34%
LAKE TROUT																	0	0	0	0.00%
RAINBOW SMELT																	0	0	0	0.00%
WHITE SUCKER					1			2		2			2	6	3	1	11	6	17	29.31%
CARP	3			1													3	1	4	6.90%
BROWN BULLHEAD	1									1					1		2	1	3	5.17%
AMERICAN EEL																	0	0	0	0.00%
WHITE PERCH							7						2	3		2	5	9	14	24.14%
WHITE BASS																1	0	1	1	1.72%
ROCK BASS										1					1		1	1	2	3.45%
PUMPKINSEED	1								1								2	0	2	3.45%
SMALLMOUTH BASS			1														0	1	1	1.72%
YELLOW PERCH							1		1		1				2		1	4	5	8.62%
LAKE CHUB																	0	0	0	0.00%
LONGNOSE SUCKER																	0	0	0	0.00%
TOTAL	5	1	2	1	1	0	8	6	3	5	1	0	5	9	7	4	29	29	58	100.00%

Appendix III

APPENDIX III
PICKERING GILL NETS
MAY 12 & 13, 1988

	PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SIMCOE POINT							
	3M		12M		3M		12M		3M		12M		3M		12M		TOTAL	TOTAL	TOTAL	% OF
MAY 12 & 13/88	12	13	12	13	12	13	12	13	12	13	12	13	12	13	12	13	3M	12M	CATCH	CATCH
	*																			
ALEWIFE	42	130	418	178	88	48	204	278	290	32	215	248	457	485	321	373	1572	2235	3807	91.25%
GIZZARD SHAD		3				3				3				2			11	0	11	0.26%
COHO SALMON																	0	0	0	0.00%
CHINOOK SALMON																	0	0	0	0.00%
RAINBOW TROUT				1													0	1	1	0.02%
BROWN TROUT		4	3	4	36	14	1		3	13		2		4			74	10	84	2.01%
LAKE TROUT					1		7	9		7		2			10	3	8	31	39	0.93%
LAKE WHITEFISH				1													0	1	1	0.02%
ROUND WHITEFISH			22	10	3				3			6				1	6	39	45	1.08%
RAINBOW SMELT					5		4	1	8		1			7	2	1	20	9	29	0.70%
NORTHERN PIKE																	0	0	0	0.00%
LONGNOSE SUCKER										10			5			2	15	2	17	0.41%
WHITE SUCKER		6	11	2	7	3	2	5	15	24	3	1	6		3	7	61	34	95	2.28%
LAKE CHUB																	0	0	0	0.00%
CARP																	0	0	0	0.00%
BROWN BULLHEAD					1				2		1		5				8	1	9	0.22%
WHITE PERCH	2	3	1		3	3			4	7		2	1	3	1		26	4	30	0.72%
WHITE BASS													1				1	0	1	0.02%
ROCK BASS																	0	0	0	0.00%
SMALLMOUTH BASS								1									0	1	1	0.02%
YELLOW PERCH		1			1												2	0	2	0.05%
WALLEYE																	0	0	0	0.00%
PUMPKINSEED																	0	0	0	0.00%
FRESHWATER DRUM																	0	0	0	0.00%
SPLAKE																	0	0	0	0.00%
TOTAL	44	147	455	196	145	71	218	294	325	96	220	261	475	501	337	387	1804	2368	4172	100.00%

* - NET VANDALIZED, 3.5" TO 5.0" REMOVED

APPENDIX III
PICKERING GILL NETS
JUNE 7 & 8, 1988

	PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SIMCOE POINT							
	3M		12M		3M		12M		3M		12M		3M		12M		TOTAL	TOTAL	TOTAL	% OF
JUNE 7 & 8/88	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	3M	12M	CATCH	CATCH
ALEWIFE	13	32	356	106	79	27	77	58	88	154	331	474	230	180	111	210	803	1723	2526	92.80%
GIZZARD SHAD																	0	0	0	0.00%
COHO SALMON																	0	0	0	0.00%
CHINOOK SALMON																	0	0	0	0.00%
RAINBOW TROUT																	0	0	0	0.00%
BROWN TROUT	21	11	1		5	4			2	1			1	1			46	1	47	1.73%
LAKE TROUT		2			1				2		1			1	1	2	6	4	10	0.37%
LAKE WHITEFISH										1							1	0	1	0.04%
ROUND WHITEFISH		1	15	15	2	1			4		1	2					8	33	41	1.51%
RAINBOW SMELT				1					1						1		1	2	3	0.11%
NORTHERN PIKE																	0	0	0	0.00%
LONGNOSE SUCKER															1		0	1	1	0.04%
WHITE SUCKER	4	2	5	3	1				7	9	5	4	21	11	2	2	55	21	76	2.79%
LAKE CHUB																	0	0	0	0.00%
CARP																	0	0	0	0.00%
BROWN BULLHEAD																	0	0	0	0.00%
WHITE PERCH	2	5		1	1				3		3		2				13	4	17	0.62%
WHITE BASS																	0	0	0	0.00%
ROCK BASS																	0	0	0	0.00%
SMALLMOUTH BASS																	0	0	0	0.00%
YELLOW PERCH																	0	0	0	0.00%
WALLEYE																	0	0	0	0.00%
PUMPKINSEED																	0	0	0	0.00%
FRESHWATER DRUM																	0	0	0	0.00%
SPLAKE																	0	0	0	0.00%
TOTAL	40	53	377	126	89	32	77	58	107	165	341	480	254	193	116	214	933	1789	2722	100.00%

APPENDIX III
PICKERING GILL NETS
JULY 5,6 & 7, 1988

	PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SIMCOE POINT							
	3M		12M		3M		12M		3M		12M		3M		12M		TOTAL	TOTAL	TOTAL	% OF
JULY 5,6 & 7/88	5	6	5	6	5	6	5	6	5	6	5	6	5	6	6	7	3M	12M	CATCH	CATCH
ALEWIFE	20	70	109	217	18	84	238	188	137	292	64	94	411	330	122	222	1362	1254	2616	90.36%
GIZZARD SHAD						1			1				1				3	0	3	0.10%
COHO SALMON																	0	0	0	0.00%
CHINOOK SALMON				2													0	2	2	0.07%
RAINBOW TROUT																	0	0	0	0.00%
BROWN TROUT	2	7	1	2	2	3			3			1		1			18	4	22	0.76%
LAKE TROUT	3		1	1				1	6	6	1	3	4	6	3	3	25	13	38	1.31%
LAKE WHITEFISH																	0	0	0	0.00%
ROUND WHITEFISH		1	7	6						1		6					2	19	21	0.73%
RAINBOW SMELT			3									2					0	5	5	0.17%
NORTHERN PIKE																	0	0	0	0.00%
LONGNOSE SUCKER										1							1	0	1	0.03%
WHITE SUCKER	1	14	15	7		3	1	5	33	30	3	12	16	26	6		123	49	172	5.94%
LAKE CHUB																	0	0	0	0.00%
CARP		2				1											3	0	3	0.10%
BROWN BULLHEAD																	0	0	0	0.00%
WHITE PERCH													1	3			4	0	4	0.14%
WHITE BASS						1				1							2	0	2	0.07%
ROCK BASS																	0	0	0	0.00%
SMALLMOUTH BASS						1			3								4	0	4	0.14%
YELLOW PERCH													1				1	0	1	0.03%
WALLEYE																	0	0	0	0.00%
PUMPKINSEED																	0	0	0	0.00%
FRESHWATER DRUM		1															1	0	1	0.03%
SPLAKE																	0	0	0	0.00%
TOTAL	26	95	136	235	20	94	239	194	183	331	68	118	434	366	131	225	1549	1346	2895	100.00%

APPENDIX III
PICKERING GILL NETS
AUGUST 3 & 4, 1988

	PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SIMCOE POINT							
	3M		12M		3M		12M		3M		12M		3M		12M		TOTAL	TOTAL	TOTAL	% OF
AUGUST 3 & 4/88	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3M	12M	CATCH	CATCH
ALEWIFE	98	79	252	63	377	236	562	162	455	160	7	527	93	226	701	1287	1724	3561	5285	91.53%
GIZZARD SHAD	20	5							11	7				2			45	0	45	0.78%
COHO SALMON			7	6			2	1	1	1	1	4					2	21	23	0.40%
CHINOOK SALMON																	0	0	0	0.00%
RAINBOW TROUT	3	1		1			1	1	2	11	2				2	3	17	10	27	0.47%
BROWN TROUT	10	6	9	19	1	1	1	1	7	4	2	6	1	2	1	3	32	42	74	1.28%
LAKE TROUT			1				2				2		1		3		1	8	9	0.16%
LAKE WHITEFISH			1														0	1	1	0.02%
ROUND WHITEFISH		2	3	4			2				11	9	1		2	1	3	32	35	0.61%
RAINBOW SMELT			13	6			4	3			1	1			2	2	0	32	32	0.55%
NORTHERN PIKE																	0	0	0	0.00%
LONGNOSE SUCKER																	0	0	0	0.00%
WHITE SUCKER	41	17	5	6	9	18	3	1	17	18	3		8	6	1	2	134	21	155	2.68%
LAKE CHUB															1		0	1	1	0.02%
CARP	1					1											2	0	2	0.03%
BROWN BULLHEAD									13	4			7	2			26	0	26	0.45%
WHITE PERCH	10	3				5											18	0	18	0.31%
WHITE BASS	6	3			2	4			3					1			19	0	19	0.33%
ROCK BASS					1												1	0	1	0.02%
SMALLMOUTH BASS														1			1	0	1	0.02%
YELLOW PERCH	4	1			1	1			2	4			1	1			15	0	15	0.26%
WALLEYE					1												1	0	1	0.02%
PUMPKINSEED																	0	0	0	0.00%
FRESHWATER DRUM					1				2								3	0	3	0.05%
SPLAKE				1													0	1	1	0.02%
TOTAL	193	117	291	106	393	266	577	169	513	209	29	547	112	241	713	1298	2044	3730	5774	100.00%

APPENDIX III
PICKERING GILL NETS
SEPTEMBER 7 & 8, 1988

SEPT. 7 & 8/88	PK A DISCHARGE 3M 7	8	PK A DISCHARGE 12M 7	8	PK B DISCHARGE 3M 7	8	PK B DISCHARGE 12M 7	8	DUFFINS CREEK 3M 7	8	DUFFINS CREEK 12M 7	8	SIMCOE POINT 3M 7	8	SIMCOE POINT 12M 7	8	TOTAL 3M	TOTAL 12M	TOTAL CATCH	% OF CATCH
ALEWIFE	1		383	75	1		573	127	93	81	38	109	196	52	57	23	424	1385	1809	85.69%
GIZZARD SHAD	1								1	1							3	0	3	0.14%
COHO SALMON																	0	0	0	0.00%
CHINOOK SALMON			2												1		0	3	3	0.14%
RAINBOW TROUT													1				1	0	1	0.05%
BROWN TROUT	5		6		3				8	11		1	5				32	7	39	1.85%
LAKE TROUT			3	2			9	10	7	10	4	5	7	2	6	5	26	44	70	3.32%
LAKE WHITEFISH			3													1	0	4	4	0.19%
ROUND WHITEFISH			7	8						1	3	5			1	3	1	27	28	1.33%
RAINBOW SMELT			7												1		0	8	8	0.38%
NORTHERN PIKE																	0	0	0	0.00%
LONGNOSE SUCKER															1		0	1	1	0.05%
WHITE SUCKER	5		3	3	4		2	1	20	15	2		12	5	2		61	13	74	3.51%
LAKE CHUB																	0	0	0	0.00%
CARP	1								4	1			1	1			8	0	8	0.38%
BROWN BULLHEAD	2				1				11	1			2				17	0	17	0.81%
WHITE PERCH	12				6				6	1			1	1			27	0	27	1.28%
WHITE BASS	5									1							6	0	6	0.28%
ROCK BASS													1	3			4	0	4	0.19%
SMALLMOUTH BASS														1			1	0	1	0.05%
YELLOW PERCH	1				2					3							6	0	6	0.28%
WALLEYE																	0	0	0	0.00%
PUMPKINSEED																	0	0	0	0.00%
FRESHWATER DRUM									1				1				2	0	2	0.09%
SPLAKE																	0	0	0	0.00%
TOTAL	33	0	414	88	17	0	584	138	151	126	47	120	227	65	69	32	619	1492	2111	100.00%

APPENDIX III
PICKERING GILL NETS
OCTOBER 4 & 5, 1988

	PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SIMCOE POINT							
	3M		12M		3M		12M		3M		12M		3M		12M		TOTAL	TOTAL	TOTAL	% OF
OCT. 4 & 5/88	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	3M	12M	CATCH	CATCH
ALEWIFE	4		88	78		2	21	15	12	6	1	3		4	9	13	28	228	256	37.26%
GIZZARD SHAD	4	4		2	1				2	1	1						12	3	15	2.18%
COHO SALMON						1											1	0	1	0.15%
CHINOOK SALMON			13	12													0	25	25	3.64%
RAINBOW TROUT																	0	0	0	0.00%
BROWN TROUT	14	3	4	7	1	8	2		13	13	4	2	1	3	5	1	56	25	81	11.79%
LAKE TROUT	8	1	1	1		1	7	1	2	3	3	1	5	1	1	1	21	16	37	5.39%
LAKE WHITEFISH			1	2									1				1	3	4	0.58%
ROUND WHITEFISH	3		1	1					13	1	7						17	9	26	3.78%
RAINBOW SMELT			3	7							3	1					0	14	14	2.04%
NORTHERN PIKE		1															1	0	1	0.15%
LONGNOSE SUCKER																	0	0	0	0.00%
WHITE SUCKER	5	3	1	5	1	1	4	5	13	3	9	2	7	1	8	1	34	35	69	10.04%
LAKE CHUB																	0	0	0	0.00%
CARP	2	2	7	8		1				3							8	15	23	3.35%
BROWN BULLHEAD	2			3					11								13	3	16	2.33%
WHITE PERCH	16	15	1	2	7	7	4	2	4	2	4		4	2		1	57	14	71	10.33%
WHITE BASS	1	3		2		4	5	1			1		1				9	9	18	2.62%
ROCK BASS												1					0	1	1	0.15%
SMALLMOUTH BASS					1					1							2	0	2	0.29%
YELLOW PERCH	3	1		6			1		1	2	5	2		2			9	14	23	3.35%
WALLEYE									1								1	0	1	0.15%
PUMPKINSEED		1															1	0	1	0.15%
FRESHWATER DRUM																2	0	2	2	0.29%
SPLAKE																	0	0	0	0.00%
TOTAL	62	34	120	136	11	25	44	24	72	35	38	12	19	13	23	19	271	416	687	100.00%

APPENDIX III
PICKERING GILL NETS
NOVEMBER 2 & 3, 1988

	PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SIMCOE POINT							
	3M		12M		3M		12M		3M		12M		3M		12M		TOTAL	TOTAL	TOTAL	% OF
NOV. 2 & 3/88	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	3M	12M	CATCH	CATCH
ALEWIFE							1										0	1	1	0.29%
GIZZARD SHAD	13					7			1	3				1			25	0	25	7.14%
COHO SALMON																	0	0	0	0.00%
CHINOOK SALMON				2													0	2	2	0.57%
RAINBOW TROUT																	0	0	0	0.00%
BROWN TROUT	5			4	4	1				6	3	3	2	2			20	10	30	8.57%
LAKE TROUT	3			12	10	17	6	13	2	14	9	16	10	5	9	7	61	72	133	38.00%
LAKE WHITEFISH																	0	0	0	0.00%
ROUND WHITEFISH	1			7	1		3	8	1		3	3	2	2	2	1	7	27	34	9.71%
RAINBOW SMELT																	0	0	0	0.00%
NORTHERN PIKE	1																1	0	1	0.29%
LONGNOSE SUCKER																	0	0	0	0.00%
WHITE SUCKER	3			5	6	11	3	2	11	6	5	3	2	1	2	3	40	23	63	18.00%
LAKE CHUB																1	0	1	1	0.29%
CARP																	0	0	0	0.00%
BROWN BULLHEAD																	0	0	0	0.00%
WHITE PERCH	8			2	2	22			1	4			1			2	38	4	42	12.00%
WHITE BASS				1	1		2			2			2		1		5	4	9	2.57%
ROCK BASS																	0	0	0	0.00%
SMALLMOUTH BASS																	0	0	0	0.00%
YELLOW PERCH	3					2			2								7	0	7	2.00%
WALLEYE						1											1	0	1	0.29%
PUMPKINSEED																	0	0	0	0.00%
FRESHWATER DRUM													1				1	0	1	0.29%
SPLAKE																	0	0	0	0.00%
TOTAL	37	0	0	33	24	61	15	23	18	35	20	25	20	11	14	14	206	144	350	100.00%

Appendix IV

APPENDIX IV

COMMON AND SCIENTIFIC NAMES OF FISH SPECIES COLLECTED DURING THE 1987 PICKERING NGS B POSTOPERATIONAL STUDY

COMMON NAME	SCIENTIFIC NAME
Alewife	Alosa pseudoharengus
White sucker	Catostomus commersoni
Brown bullhead	Ictalurus nebulosus
Lake trout	Salvelinus namaycush
Rainbow smelt	Osmerus mordax
White perch	Morone americana
Round whitefish	Prosopium cylindraceum
Brown trout	Salmo trutta
White bass	Morone chrysops
Spottail shiner	Notropis hudsonius
Gizzard shad	Dorosoma cepedianum
Pink salmon	Oncorhynchus gorbuscha
Coho salmon	Oncorhynchus kisutch
Yellow perch	Perca flavescens
Golden shiner	Notemigonus crysoleucas
Longnose dace	Rhinichthys cataractae
Carp	Cyprinus carpio
Smallmouth bass	Micropterus dolomieui
Rainbow trout	Salmo gairdneri
Pumpkinseed	Lepomis gibbosus
Lake whitefish	Coregonus clupeaformis
Rock bass	Ambloplites rupestris
Logperch	Percina caprodes
Amercan eel	Anguilla rostrata
Northern pike	Esox lucius
Walleye	Stizostedion vitreum
Slimy sculpin	Cottus cognatus
Lake chub	Coiesius plumbeus
Fathead minnow	Pimephales promelas
Black crappie	Pomoxis nigromaculatus
Emerald shiner	Notropis atherinoides
Chinook salmon	Onchorhynchus tshawytscha
Freshwater drum	Aplodinotus grunniens
Bluntnose minnow	Pimephales notatus
Bowfin	Amia calva
Redhorse sucker	Moxostoma sp
Longnose sucker	Catostomus catostomus
Mottled sculpin	Cottus biardi
Common shiner	Notropis cornutus

Appendix V

APPENDIX V

1988 TEMPERATURES (°C) AT PICKERING NGS B BEACH SEINE LOCATIONS

	PICKERING NGS A DISCHARGE	PICKERING NGS B DISCHARGE	DIFFINS CREEK	SIMCOE POINT
MAY 18	14	13	12	10
JUNE 14	13	10	15	ND
JULY 13	21	21	15	17
SEPT 14	ND	ND	ND	ND
OCT 5	14	16	12	12

ND-No Data

Appendix VI

APPENDIX VI

1988 TEMPERATURES (°C) AT PICKERING NGS B TRAP NET LOCATIONS

	PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SIMCOE POINT			
	EAST		WEST		EAST		WEST		EAST		WEST		EAST		WEST	
	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B
MAY 16	16.0	14.9	12.4	8.9	11.2	8.7	17.3	8.6	10.9	9.0	10.8	9.0	10.0	9.0	10.0	9.0
MAY 17*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MAY 18	15.3	13.5	14.8	13.4	9.1	8.8	10.5	8.7	9.3	9.1	9.1	9.1	8.7	8.7	8.7	8.7
JUNE 13	13.8	13.2	13.7	11.0	6.8	6.7	11.5	6.2	7.9	6.4	7.9	6.4	8.3	5.8	8.3	5.8
JUNE 14	12.0	9.9	12.0	9.4	10.0	6.0	10.3	6.3	7.7	6.5	7.0	6.5	8.0	5.8	8.0	5.8
JUNE 15	14.2	13.1	14.1	13.0	7.0	5.8	6.7	5.6	9.0	6.3	8.0	6.4	7.5	5.5	7.2	5.6
JULY 12	20.0	18.6	18.9	18.4	15.2	11.6	14.4	11.4	16.4	11.8	17.0	11.7	13.0	12.3	13.0	12.3
JULY 13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
JULY 14	23.7	21.7	22.9	22.2	20.0	15.2	18.9	15.0	17.9	17.8	17.9	17.8	18.3	14.8	18.2	15.2
AUG 8	22.4	22.0	22.4	17.0	18.0	12.6	20.2	14.0	16.7	14.9	16.7	14.9	16.2	13.1	16.2	13.2
AUG 9	27.0	24.0	27.0	24.0	22.0	19.0	23.0	23.0	18.0	18.0	18.0	18.0	17.0	17.0	17.0	17.0
AUG 10	21.3	17.5	21.5	18.2	18.3	12.4	13.6	12.1	13.6	12.4	13.4	12.5	14.2	13.2	14.1	12.5
SEPT 12	19.4	19.3	19.4	19.3	9.7	9.7	9.7	9.7	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
SEPT 13	19.6	19.8	19.2	17.3	13.7	10.7	18.0	10.6	10.2	10.2	10.2	10.2	12.6	12.2	12.6	12.2
SEPT 14	16.2	12.8	15.1	12.1	9.2	7.9	13.4	7.9	7.3	7.3	7.3	7.3	7.6	7.6	7.6	7.6
OCT 11	20.8	17.2	16.2	16.6	20.5	15.7	24.1	16.5	14.8	14.7	14.4	14.4	15.2	15.1	15.1	15.0
OCT 12	15.3	11.0	16.1	10.8	17.3	11.6	20.9	12.2	8.9	8.9	8.9	8.9	9.0	8.5	9.3	8.9
OCT 13	12.6	8.4	14.0	7.3	15.3	9.9	17.0	10.1	8.9	8.9	8.7	8.5	9.6	9.4	9.5	9.5

*Adverse wheather conditions precluded use of temperature meter

ND - no data

Appendix VII

APPENDIX VII

1988 SURFACE AND BOTTOM TEMPERATURES (°C) AT GILL NET LOCATIONS

		PK A DISCHARGE				PK B DISCHARGE				DUFFINS CREEK				SINCOE POINT			
		3M		12M		3M		12M		3M		12M		3M		12M	
DATE	GILL NETS	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O
MAY 11	SURFACE	16.4	11.9	7.0	7.1	7.5	11.8	7.9	7.7	7.7	7.0	6.8	6.7	7.4	7.8	7.2	7.2
	BOTTOM	10.2	7.3	6.2	6.2	7.4	7.2	6.5	6.3	6.9	6.8	6.2	6.2	7.4	7.2	6.8	6.6
MAY 12	SURFACE	16.0	15.9	11.3	11.1	10.2	14.4	10.9	10.1	7.5	7.7	7.3	7.2	7.9	7.7	7.4	7.4
	BOTTOM	16.0	6.7	6.4	6.3	7.2	6.7	6.3	6.4	7.1	7.5	6.2	6.1	7.7	7.1	6.2	6.2
MAY 13	SURFACE	20.4	20.4	8.4	8.4	23.4	20.2	8.2	8.7	9.7	9.3	8.8	8.7	10.0	9.7	8.6	9.0
	BOTTOM	12.7	12.7	7.5	7.3	8.6	8.8	6.8	6.3	9.6	9.1	6.6	6.3	10.0	9.7	6.6	6.8
JUNE 6	SURFACE	14.4	10.9	7.6	7.8	17.2	16.9	7.6	8.2	13.0	7.5	8.1	8.2	6.9	6.9	7.7	7.9
	BOTTOM	10.6	6.4	5.5	5.4	7.9	7.5	5.3	5.3	6.9	6.0	5.7	5.7	6.8	6.2	5.5	5.4
JUNE 7	SURFACE	15.0	14.5	14.2	13.3	15.4	17.7	9.2	9.2	7.8	8.1	8.5	8.5	7.1	7.4	8.2	8.4
	BOTTOM	6.9	5.9	5.5	5.5	6.7	7.1	5.7	5.7	6.1	5.8	5.8	5.8	6.4	6.2	5.7	5.8
JUNE 8	SURFACE	12.4	14.0	9.2	9.6	10.7	12.5	8.2	8.2	7.1	6.9	6.7	6.7	6.4	6.2	6.6	7.6
	BOTTOM	7.6	5.9	5.2	5.2	6.7	6.3	5.1	5.0	6.2	6.1	5.4	5.3	6.2	6.1	5.5	5.3
JULY 4	SURFACE	14.4	14.6	13.7	14.0	17.1	17.9	13.4	13.4	9.4	10.5	45.3	12.3	8.7	10.8	12.9	12.6
	BOTTOM	6.4	6.4	5.3	5.0	9.8	6.9	6.5	6.5	7.9	6.9	6.3	6.0	12.1	7.8	5.8	5.7
JULY 5	SURFACE	14.6	15.2	15.9	15.1	17.8	17.8	12.9	14.3	12.8	11.8	12.3	12.6	12.2	13.0	12.1	13.4
	BOTTOM	7.3	8.9	7.3	7.0	14.4	9.2	7.0	6.8	10.4	10.3	7.3	7.8	9.2	7.3	9.8	10.4
JULY 6	SURFACE	15.6	15.2	14.2	14.2	19.5	18.0	15.5	15.5	18.5	15.7	14.2	16.5	16.5	16.6	13.7	13.6
	BOTTOM	12.9	9.6	8.5	8.3	12.5	9.8	7.2	7.2	12.4	11.7	7.9	7.4	11.3	11.1	8.5	7.4
AUG 2	SURFACE	23.6	23.7	20.0	20.0	21.1	19.0	17.0	18.2	16.7	16.6	17.2	17.2	17.3	17.3	16.9	17.3
	BOTTOM	13.0	12.2	11.4	11.0	16.9	15.3	12.0	11.7	14.4	13.0	11.6	11.5	14.4	13.4	11.5	11.3
AUG 3	SURFACE	27.2	26.1	22.8	23.2	24.5	21.7	23.5	22.5	20.7	20.9	21.4	22.1	20.5	19.1	21.7	21.7
	BOTTOM	17.6	17.3	16.4	16.3	18.1	18.3	12.9	12.7	18.5	18.7	13.6	13.4	18.4	18.3	13.2	13.2
AUG 4	SURFACE	27.0	26.5	23.4	21.8	25.4	24.2	23.1	23.6	20.5	250.7	20.7	21.1	21.2	21.3	21.6	22.0
	BOTTOM	17.6	17.4	16.4	15.4	18.7	18.3	12.8	12.7	19.0	18.6	13.0	12.8	20.1	19.7	13.5	12.7
SEPT 6	SURFACE	19.4	18.3	17.0	16.1	20.5	21.0	19.6	19.4	14.9	14.7	16.0	16.1	15.2	14.6	15.4	15.6
	BOTTOM	19.3	11.3	9.6	9.3	15.3	13.9	10.8	10.5	14.2	12.0	10.2	9.4	15.0	12.3	9.2	8.3
SEPT 7	SURFACE	14.0	13.7	12.0	12.0	15.2	19.0	15.9	15.3	9.2	9.1	12.1	12.9	9.3	9.1	15.2	15.3
	BOTTOM	8.8	8.4	6.6	6.6	9.5	10.4	7.0	7.0	8.1	8.1	7.2	7.1	9.3	8.3	8.3	8.0
SEPT 8	SURFACE			12.3	12.7			15.1	16.1	10.2	11.2	12.2	12.4	10.2	10.4	11.8	11.8
	BOTTOM			5.7	5.7			5.4	5.3	7.4	6.9	6.2	6.0	7.3	7.2	6.1	6.0
OCT 3	SURFACE	20.2	18.4	15.5	15.2	18.0	19.2	15.7	15.3	14.0	14.0	14.2	14.2	14.2	14.2	14.3	14.3
	BOTTOM	20.1	13.8	13.6	13.7	14.2	14.3	14.1	14.1	14.0	14.0	14.1	14.1	14.2	14.2	14.2	14.2
OCT 4	SURFACE	19.5	20.2	17.0	17.5	14.1	14.4	14.3	14.3	13.6	13.7	14.2	14.2	13.9	14.1	14.4	14.4
	BOTTOM	14.4	14.5	14.2	14.2	14.2	14.4	14.3	14.3	13.6	13.8	14.2	14.2	14.0	14.1	14.4	14.4
OCT 5	SURFACE	19.7	20.3	16.8	16.7	20.5	21.1	17.8	16.9	14.5	14.4	14.7	14.7	14.1	14.2	14.9	14.9
	BOTTOM	14.9	14.8	14.4	14.4	14.3	14.2	14.6	14.6	13.3	12.0	14.0	13.9	13.7	13.8	14.3	14.3
NOV 1	SURFACE	16.9	12.3	8.4	6.9	17.9	9.3	6.3	5.6	6.3	5.9	5.9	5.9	6.0	5.9	6.0	5.9
	BOTTOM	8.4	6.9	5.5	5.5	8.3	6.6	5.6	5.6	6.3	5.9	5.9	5.9	6.0	5.9	6.0	5.9
NOV 2	SURFACE	7.2	7.2			18.2	18.4	6.0	6.1	6.2	6.2	6.1	5.9	6.2	5.9	5.9	6.0
	BOTTOM	7.2	7.2			7.8	10.1	6.0	6.1	6.2	6.2	6.0	5.9	6.2	5.9	5.8	5.9
NOV 3	SURFACE			6.4	6.3	18.5	16.5	12.3	10.8	6.6	6.4	5.8	5.8	6.6	6.6	5.9	5.7
	BOTTOM			5.8	5.8	6.3	10.0	5.9	5.9	6.6	6.4	5.8	5.8	6.6	6.6	5.6	5.4

Appendix VIII

APPENDIX VIII
PICKERING NGS B, 1988
MAXIMUM, MINIMUM AND AVERAGE TEMPERATURES (°C) RECORDED BY CONTINUOUS MONITORS AT THE 3M DEPTH CONTOUR ALONG FOUR TRANSECTS FISHED (GEOTECHNICAL AND HYDRAULIC ENGINEERING DEPARTMENT)

	PICKERING NGS A DISCHARGE			PICKERING NGS B DISCHARGE			DUFFIN CREEK			SIMCOE POINT		
	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
GILL NETS												
MAY 11	10.6	6.6	7.6	INSTRUMENT FAILURE			7		6			
MAY 12	10	5.7	7.3				7.2		6	INSTRUMENT FAILURE		
MAY 13	12.5	5.5	9.4				9.1		6.4			
JUNE 6	11.1	5.4	7.7	17.5	6.9	10.5	6.7		0.2	7.7	6.5	7.1
JUNE 7	12	5	7.1	15.8	6.7	10.6	7.2		5.4	8	6	6.7
JUNE 8	10.6	5	6.5	13.6	5.4	6.9	6.4		5	7	5.8	6.3
JULY 4	11.3	6.2	7.3	14	6.4	9.3	11.4		6.4	11.9	6.6	8.9
JULY 5	15.1	7.4	10.3	11.6	9.1	10.3	11.4		8.6	11	9.9	10.3
JULY 6	13.1	7.1	8.5	11.8	9	10.4	12.2		8.6	12.6	9.7	11
AUG 2	19.1	11.3	15.3	19.9	14.5	17	20.1		13	19.8	13.2	16.7
AUG 3	19.3	13.6	16.5	27.8	15.6	19.2	21.6		16.6	21.1	17	18.8
AUG 4	18.2	13.6	16.3	21	16.2	18.1	22		17.2	22	17.8	19.5
SEPT 6	18.9	12.3	15.5	25.9	13.1	16.4	INSTRUMENT FAILURE			16.6	10.3	13.8
SEPT 7	15.3	7.4	11.5	21.8	8.9	13.3				12.8	6.8	10.2
SEPT 8	14.5	6.2	9.7	20.8	7.9	11.7				11.9	6.6	8.6
OCT 3	16.7	13.6	14.6	14.4	13.9	14.2	13.6		12.9	13.5	13.1	13.3
OCT 4	19.3	14.5	15.3	14.2	13.5	14	13.6		12.3	13.5	12.9	13.2
OCT 5	17.3	14.5	15.2	14.4	14.1	14.3	13.4		11.4	13.3	12.4	13.1
NOV 1	10.6	5.7	7.8	9.2	5.7	6.9	5.5		5.2	INSTRUMENT FAILURE		
NOV 2	10.4	7.6	8.2	19.2	6	8.8	5.7		5			
NOV 3	10.2	7.4	8.2	9	5.8	7.4	6.4		5			
TRAP NETS												
MAY 16	10	6.7	7.4	INSTRUMENT FAILURE			9.6		6.9	INSTRUMENT FAILURE		
MAY 17	9.1	6.2	6.6				9.5		7.4			
MAY 18	7.8	6.2	6.7				9.3		7.6			
JUNE 13	10.6	4.4	7.3	12.3	4.9	7.2	5.2		4.2	5.6	5	5.3
JUNE 14	12.5	4.2	6.5	16.2	4.9	6.2	6.2		4.4	5.8	4.6	5.2
JUNE 15	12.2	3.4	4.6	7.9	4.2	5.1	7.4		4.6	8.7	4.5	5.8
JULY 12	12.7	8.1	9	11.6	9.7	10.6	12.2		10.1	12.8	9.6	10.9
JULY 13	16	8.5	11.2	17.8	10.6	14.3	17.3		10.1	18.1	11	14.7
JULY 14	17.5	10.3	12.8	17.6	12.2	14.4	17.5		11.2	17.6	12.2	14.7
AUG 8	14.9	9.9	12	22.1	11.3	14.2	15.1		11.7	15	11.3	12.6
AUG 9	15.4	10.7	12.7	18.9	12	14.4	16.1		11.5	16.8	12.1	14.1
AUG 10	14.7	10.6	11.8	19.3	11.1	12.2	INSTRUMENT FAILURE			16.1	11.3	13.2
SEPT 12	11.6	7.2	9	11.1	8.3	9.9	INSTRUMENT FAILURE			11.9	8.5	10.1
SEPT 13	16	6.7	9.5	22.1	7	9.9				12.2	6.4	8.8
SEPT 14	12.5	6.6	8.6	20.2	6.1	9.1				7.5	6.6	7
OCT 11	15.1	9	13.2	27.1	12.7	19.1	15.8		8.5	INSTRUMENT FAILURE		
OCT 12	11.1	5.5	8.3	22.9	8.2	15	8.6		6.9			
OCT 13	6.1	5.2	5.6	19.5	7.4	11.9	6.7		5.7			

Appendix IX

APPENDIX IX

ROUND WHITEFISH STUDY - PICKERING NGS 'B', 1988

1 - DECEMBER 21
2 - DECEMBER 22

	DEPTH	PICKERING A DISCHARGE		PICKERING B DISCHARGE		SINCOE POINT		RICHARDSON POINT		WHITBY WEST		THICKSON POINT		TOTAL	TOTAL	TOTAL
	DATE	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	
		1	1	1	1	1	1	2	2	2	2	2	2			
WHITE SUCKER		3	24	2	1	3	2	3	2	2			1	13	30	43
BROWN TROUT		1	5	2	4	12	5	1		1	2			17	16	33
LAKE TROUT						4	2				1	1		5	3	8
ROUND WHITEFISH		2	4		51	1	7	2	2		1	10	2	15	67	82
YELLOW PERCH		4	1											4	1	5
WHITE PERCH		18	4	69		3	4			1	2			91	10	101
RAINBOW TROUT				1		1								2	0	2
GIZZARD SHAD		3		3										6	0	6
WHITE BASS		5	1	14	3	14		1						34	4	38
FRESHWATER DRUM				1										1	0	1
SMALLMOUTH BASS														0	0	0
BROWN BULLHEAD				2				1		1				4	0	4
NORTHERN PIKE														0	0	0
ALEWIFE														0	0	0
LAKE CHUB														0	0	0
COHO SALMON														0	0	0
CHINOOK SALMON														0	0	0
WALLEYE					1			1			1			1	2	3
ROCK BASS														0	0	0
RAINBOW SMELT														0	0	0
SCULPIN														0	0	0
CARP		1		1						1	1			3	1	4
TOTAL		37	39	95	60	38	20	9	4	6	8	11	3	196	134	330

APPENDIX IX

ROUND WHITEFISH STUDY - PICKERING NGS 'B', 1988

1 - DECEMBER 15
2 - NO SET

	PICKERING A DISCHARGE		PICKERING B DISCHARGE		SIMCOE POINT		RICHARDSON POINT		WHITBY WEST		THICKSON POINT		TOTAL 3M	TOTAL 7M	TOTAL
DEPTH	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M			
DATE	2	1	1	1	1	1	2	2	2	2	2	2			
WHITE SUCKER		4	2	1	2	1							4	6	10
BROWN TROUT		1	8	12	11	2							19	15	34
LAKE TROUT		2	1	1		1							1	4	5
ROUND WHITEFISH		4	2	94	4	6							6	104	110
YELLOW PERCH													0	0	0
WHITE PERCH		1	81	1	1	2							82	4	86
RAINBOW TROUT													0	0	0
GIZZARD SHAD		1	64	1	1								65	2	67
WHITE BASS			79		5	1							84	1	85
FRESHWATER DRUM													0	0	0
SMALLMOUTH BASS			1										1	0	1
BROWN BULLHEAD			3										3	0	3
NORTHERN PIKE			1										1	0	1
ALEWIFE													0	0	0
LAKE CHUB													0	0	0
COHO SALMON													0	0	0
CHINOOK SALMON													0	0	0
WALLEYE													0	0	0
ROCK BASS													0	0	0
RAINBOW SMELT													0	0	0
SCULPIN													0	0	0
CARP			1										1	0	1
TOTAL	0	13	243	110	24	13	0	0	0	0	0	0	267	136	403

APPENDIX IX

ROUND WHITEFISH STUDY - PICKERING NGS 'B', 1988

1 - DECEMBER 9
2 - DECEMBER 7
3 - DECEMBER 8

	DEPTH	PICKERING A DISCHARGE		PICKERING B DISCHARGE		SIMCOE POINT		RICHARDSON POINT		WHITBY WEST		THICKSON POINT		TOTAL 3M	TOTAL 7M	TOTAL
	DATE	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M			
		1	1	1	1	1	1	2	2	3	3	3	3			
WHITE SUCKER		8	6	4	1		2	1	2	1	1	4	1	18	13	31
BROWN TROUT		2	2	6	1	10	1	1		6	3	7	2	32	9	41
LAKE TROUT						3				2	1	1	2	6	3	9
ROUND WHITEFISH			3	4	6	1	4	8		5	2	10	28	28	43	71
YELLOW PERCH		3								1			1	4	1	5
WHITE PERCH			1	65								1		66	1	67
RAINBOW TROUT				1					1					1	1	2
GIZZARD SHAD				5		2								7	0	7
WHITE BASS				58		4			1			3		65	1	66
FRESHWATER DRUM														0	0	0
SMALLMOUTH BASS				1										1	0	1
BROWN BULLHEAD														0	0	0
NORTHERN PIKE														0	0	0
ALEWIFE									1					0	1	1
LAKE CHUB														0	0	0
COHO SALMON														0	0	0
CHINOOK SALMON														0	0	0
WALLEYE														0	0	0
ROCK BASS														0	0	0
RAINBOW SMELT		1												1	0	1
SCULPIN												1	1	1	1	2
CARP				3										3	0	3
TOTAL		14	12	147	8	20	7	10	5	15	7	27	35	233	74	307

APPENDIX IX
ROUND WHITEFISH STUDY - PICKERING NGS 'B', 1988

1 - DECEMBER 2
2 - NOVEMBER 29

	PICKERING A DISCHARGE		PICKERING B DISCHARGE		SIMCOE POINT		RICHARDSON POINT		WHITBY WEST		THICKSON POINT		TOTAL 3M	TOTAL 7M	TOTAL
DEPTH	3M	7M	3M	7M	*3M	7M	3M	7M	3M	7M	3M	7M			
DATE	1	1	1	1	1	1	1	1	2	2	2	2			
WHITE SUCKER	3	3			3		4	1	8	3	1		19	7	26
BROWN TROUT	2		15		6	3	2	1	1	2	3		29	6	35
LAKE TROUT		1			1	1		1	2		1	2	4	5	9
ROUND WHITEFISH	1	1	3	9	2	3	2	9	5	4	4	11	17	37	54
YELLOW PERCH	5		1						2	1			8	1	9
WHITE PERCH	1		106		4								111	0	111
RAINBOW TROUT			1									1	1	1	2
GIZZARD SHAD			3		2								5	0	5
WHITE BASS	1		42		1				1				45	0	45
FRESHWATER DRUM			11										11	0	11
SMALLMOUTH BASS									1				1	0	1
BROWN BULLHEAD									1			1	1	1	2
NORTHERN PIKE													0	0	0
ALEWIFE		1						8		6			0	15	15
LAKE CHUB													0	0	0
COHO SALMON													0	0	0
CHINOOK SALMON													0	0	0
WALLEYE													0	0	0
ROCK BASS			1										1	0	1
RAINBOW SMELT													0	0	0
SCULPIN													0	0	0
CARP					1								1	0	1
TOTAL	13	6	183	9	20	7	8	20	21	16	9	15	254	73	327

* - INCLUDES REMAINDER OF NET RETRIEVED ON DECEMBER 5,1988

APPENDIX IX
ROUND WHITEFISH STUDY - PICKERING NGS 'B', 1988

1 - NOVEMBER 23
2 - NOVEMBER 22

	PICKERING A DISCHARGE		PICKERING B DISCHARGE		SIMCOE POINT		RICHARDSON POINT		WHITBY WEST		THICKSON POINT		TOTAL 3M	TOTAL 7M	TOTAL
DEPTH	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M	3M	7M			
DATE	1	1	1	1	1	1	2	2	2	2	2	2			
WHITE SUCKER		6	11	1	4	3	3		1			1	19	11	30
BROWN TROUT	2	3	17	6	1	3	3	1	1	4	2		26	17	43
LAKE TROUT			3	6			2				1		6	6	12
ROUND WHITEFISH	2	3		3	2			2			3	4	7	12	19
YELLOW PERCH	1								2				3	0	3
WHITE PERCH	2	1	11	2	1	1							14	4	18
RAINBOW TROUT													0	0	0
GIZZARD SHAD	10		1										11	0	11
WHITE BASS	1		2		2		2			1		1	7	2	9
FRESHWATER DRUM													0	0	0
SMALLMOUTH BASS													0	0	0
BROWN BULLHEAD							3		1				4	0	4
NORTHERN PIKE													0	0	0
ALEWIFE													0	0	0
LAKE CHUB				1									0	1	1
COHO SALMON					2								2	0	2
CHINOOK SALMON			1										1	0	1
WALLEYE													0	0	0
ROCK BASS													0	0	0
RAINBOW SMELT													0	0	0
SCULPIN													0	0	0
CARP	2												2	0	2
TOTAL	20	13	46	19	12	7	13	3	5	5	6	6	102	53	155

Appendix X

APPENDIX X

1988 TEMPERATURES (°C) AT ROUND WHITEFISH SPAWNING STUDY GILL NET LOCATIONS

		PICKERING A DISCHARGE				PICKERING B DISCHARGE				SOE POINT				RICHARDSON POINT				WHITBY WEST				THICKSON POINT			
		3M		7M		3M		7M		3M		7M		3M		7M		3M		7M		3M		7M	
		I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O
NOV 21	SURFACE													5.9	5.8	5.7	5.6	5.6	5.4	5.4	5.4	5.5	5.4	5.5	5.4
	BOTTON													5.9	5.8	5.8	5.6	5.6	5.4	5.4	5.4	5.4	5.4	5.4	5.4
NOV 22	SURFACE	15.9	16.4	9.6	10.7	8.2	9.3	11.3	10.5	5.6	5.5	5.7	5.8	5.5	5.6	5.4	5.4	5.2	5.2	5.3	5.4	5.4	5.2	5.1	5.3
	BOTTON	6.2	5.7	5.7	5.8	5.6	5.4	5.4	5.4	5.7	5.5	5.6	5.6	5.5	5.6	5.4	5.4	5.2	5.2	5.3	5.3	5.4	5.2	5.2	5.3
NOV 23	SURFACE	16.5	15.7	12.9	14.1	5.7	7.3	10.4	11.5	5.3	5.3	5.6	5.7												
	BOTTON	9.3	6.2	6.3	6.2	5.6	5.7	5.4	5.5	5.3	5.3	5.3	5.7												
NOV 28	SURFACE													8.7	7.6	6.7	6.6	5.9	5.5	5.5	6.2	5.9	5.5	5.5	5.4
	BOTTON													8.7	7.6	6.7	6.6	5.9	5.5	5.5	6.2	6	5.5	5.5	5.4
NOV 29	SURFACE													7	7	6.7	6.6	6.8	6.78	6.5	6.5	6.5	6.5	6.4	6.4
	BOTTON													7	7	6.5	6.4	6.9	6.7	6.5	6.5	6.8	6.7	6.4	6.3
DEC 1	SURFACE	15.6	13	5	5	14	14.3	5.2	5.4	5.9	6.1	5.7	5.9												
	BOTTON	6	5.2	5	5	7.5	8.7	5.1	4.8	5.9	6.1	5.7	5.5												
DEC 2	SURFACE		4.6		4.6	4.7	4.5		4.6	4.6		4.6													
	BOTTON		4.6		4.6	4.7	4.5		4.6	4.6		4.6													
DEC 6	SURFACE													5.6	5.7	5.9	6								
	BOTTON													5.6	5.7	5.8	6								
DEC 7	SURFACE													6.3	6.4	8.7	8.2	7.7	7.3	6.8	6.5	5.4	5.7	6.3	6.1
	BOTTON													5.2	4.8	8.6	7.8	7.6	7.3	6.8	6.2	5.4	5.7	6.3	6.2
DEC 8	SURFACE	14.8	12.7	8.8	6.9	4.9	5	5.2	5.4	5.8	5.5	5.3	5.1					5.4	5.4	5.4	5.3	5.8	5.2	4.8	4.8
	BOTTON	5.2	4.4	4.5	4.7	5.1	4.9	5.2	5.2	5.7	5.5	5.3	5.7					5.4	5.4	5.3	5.3	5.7	5	4.8	4.9
DEC 9	SURFACE	4.9	5.2	3.9	3.8	15.5	18	5.2	5.4	6	7.1	6.7	6.3												
	BOTTON	5	5.2	3.9	3.8	9.2	8.4	5.1	5.4	5.9	7.2	6.7	6.3												
DEC 14	SURFACE		MD	10	11.1	12	10.8	12.5	10.3	5.6	5	4.8	4.8												
	BOTTON			4.7	4.6	5.3	5.8	5.4	4.9	5.7	5	4.9	4.8												
DEC 15	SURFACE		MD	3.7	3.7	19	15.9	4.9	4.9	6.4	6	5.4	5.7												
	BOTTON			3.8	3.8	17	8.5	4.9	4.9	6.3	6	5.4	5.7												
DEC 20	SURFACE	16.6	15.6	15.2	13.7	13.2	15.2	13.4	3.9	3.7	3.5	3.4	3.3												
	BOTTON	16.2	5.2	4.9	4.8	5.1	4.8	4.1	4	3.7	6.5	6.4	3.3												
DEC 21	SURFACE	13.3	4.7	3.4	3.3	14.8	14.4	4.9	3.6	6.8	6.8		MD	7.2	7.1	7.2	7.1	3.4	3.45	3.4	3.4	3.2	3.2	3.2	3.1
	BOTTON	4.3	4.8	3.5	3.3	6.5	6.7	4.8	3.6	6.8	6.8			7.1	7.1	6.2	5.5	3.4	3.4	3.4	3.4	3.2	3.2	3.2	3.1
DEC 22	SURFACE													5.6	5.6	5.7	5	3.1	3.2	4	4.9	4.3	4.7	4.4	4.1
	BOTTON													5.6	5.6	5.7	5	3.3	3.3	4.6	4.9	4.4	4.8	4.4	4.2